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Valedictory Address to the Teachers' College Teachers' Association

BY

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This occasion, the 1934 valedictory meeting of your Association is not a little tinged with gloom, for the future position of Geography in the school curriculum is very uncertain. By the recent resolution of the Academic Council relating to the revision of the S.S.L.C. Course, Geography has been swept out of the important sphere of compulsory subjects, jettisoned to the fate awaiting those optional subjects which held no pass key to the exclusive groups of the Intermediate Course. The future holds little for you, Geography students, who were looking forward, I am sure, to doing some teaching in a subject which must have captured your interest with its vitality and enthraling vistas and widening contacts. To us of an older generation who struggled for many years before getting it recognised as one of the essential subjects, the change brings with it some of the bitterness of defeat. We are back again at the old position, with Geography no longer taken seriously in the upper school, except when offered as an optional subject, and the chances of that seem remote. It is difficult to prophesy at the moment ; there are faint hopes that it may become a popular combination with the science group and also with commercial subjects. If Geography could be included in the Science group, as well as in the History Group, where it is placed at present, there would result the possibility of a more valuable combination of subjects than the scheme can offer as it is. For what could be better than the intensive study of two subjects with completely different methods and content and outlook, yet each enriching the study of the other ? I am perfectly sure that as regards their scope as *school*

subjects there is more possibility of scientific method in the treatment of school Geography than in the treatment of school Physiology, and that it has on that account more claim to be placed in the science group. There is indeed no reason why there should not be two different Geography syllabuses, each appropriate to the group in which it is included.

Every cloud has its silver lining, however, and from the point of view of the better teaching and development of the subject the outlook has some cheerful possibilities about it. Let us consider the present position for a moment. For three years Geography has enjoyed the advantage of inclusion among the compulsory subjects, and one assumes that it has, on that account, received the serious attention of teachers—that it has in fact been given a "square deal" to enable it to justify its important place in the curriculum. This is far from being the case. In the first place, the syllabus is not satisfactory; it is the emasculated remnant of the original syllabus prepared by the Geography sub-committee and opposed by all the members of the S. S. L. C. Board but one. And our chief enemies in that battle were our History colleagues who were in a large majority and who knew just enough of the subject to realize its usefulness to history, but not enough to grasp the significance of Modern Geography, which has a purpose and an aim and a cultural value of its own. We might say it was the machinations of the History speclialists that gave Geography only a one-third share of the time allotted to the linked subjects, of History and Geography, and that limited the final examination (on the Geography of the whole world) to one meagre hour. The effect was to crowd out the subject, and since it was possible for the pupil to obtain a passing mark in the combined subjects, with no marks in Geography, the harassed schools were only too glad of the opportunity to adopt a "laissez-faire" policy in regard to one subject which higher authority implied was less important. The result was, of course, that little attempt was made to ensure that it was being taught by persons with some inkling of the aims and methods of Modern Geography. It is not surprising, therefore, to hear complaints on all sides that the subject is being badly taught. It is in any case one of the most difficult to teach; and while the groping enthusiast, even if he begins with no back-ground of geographical knowledge, can do little serious harm, the indifferent and ignorant teacher can, in my opinion, do a world of harm. It is just as pitiful to see the regional sequence treated with no imagination and in a stereotyped way as to observe a lesson of the "capes and bays"

method. It is exasperating to listen to pupils using terms like irrigation, agriculture, water-power, etc., without the faintest glimmering of the processes involved and the part played by man; one knows at once that there has been no attempt to build up the geographical concept implied in each; and it is positively tragic to come across evidence of bad habits of thinking—superficial generalisation, particularly. This is the danger of Geography, when *not* taught properly—it is apt to encourage loose thinking and bad habits of inaccuracy and slovenliness. We must face the fact that there has been a great deal of poor teaching during the last three years.

That then is the position at present, not so cheerful that we want to retain things as they are.

The trouble with our Geography teaching is that we have begun at the wrong end, rather we have begun at one end, the top, and forgotten all about the bottom. We must concentrate now on the teaching of Geography in the lower school, and in the training schools. The Madras Geographical Association can do a great deal in stimulating a real interest in the subject among secondary and elementary teachers, just as it has done among graduates. It can also help by giving guidance, and one of the first obstacles to be cleared away is the standardised syllabus. It is all wrong to believe that there must be a uniform Geography syllabus throughout all schools in the Presidency; it might make it easier for the inspecting authorities, but it is a barrier to good Geography teaching. One reason is that the uniform detailed syllabus rules out completely "Home Geography", which should be the very fabric of the course. The Geographical Association should work out more than one type of 'approval' syllabus and should encourage schools to prepare syllabuses on similar lines, each modified according to the individual needs of the school. There is great opportunity here, for with no compelling and cramping examination at the end of the middle school, there is plenty of scope for experiment and for individual development in each school in harmony with its particular environment and the nature of the human material composing it. Teaching syllabuses in Geography should be planned with a due proportion of "Home Geography" and "Geography of the world" in each stage; and the difficulty is you can't finish off any one aspect at any one stage, but each must find its place concurrently with the other up through the grades, from class III to Form VI. One of the reasons for the deplorable teaching in the junior classes is the nature of the syllabus set, which is

founded on a principle no longer accepted as either sound or practicable as far as syllabuses are concerned. "From the known to the unknown" was once upon a time considered an excellent guide in determining the sequence of regions to which the pupil was to be introduced. It was developed into the idea of "first the village, then the taluk, the district, the country and finally the world". This is quite dead now. Its impracticability has been realised, for it has been found impossible to arrange for a sequence of geographical ideas in their order of difficulty to fit into a scheme of this type. The geographical story *must* be the beginning, and you can't find such stories with the taluk as the back-ground—it has to be the world. So, we must begin with the world as the back-ground of the story, and at the same time there must be an awakening to simple geographical things in the immediate environment.

As a matter of fact also, we have realised, when trying to put into practical effect, that what is beyond the horizon by a few miles is generally as little known as if it were thousands of miles away. The farther part of the taluk is likely to be far less known to the young pupil than places with the magical names of Delhi, Bombay and Calcutta; it is pretty certain to be also, from a geographical point of view, deadly uninteresting. There is nothing geographical in the determination of the boundaries of taluk or district, so it is not even a geographical region. By "Home Geography" therefore is not meant taluk geography; and so when we set the Geography of the Taluk as the syllabus for class 4, we are going against the fundamentals of Geography as well as the fundamentals of Psychology. We cannot dispose of Home Geography by taking the Home Region all in a gulp, as it were. For whatever purpose we teach it, for its own sake or because it provides the best laboratory in which the child can build up, by observation and experience, his geographical concepts, the Home Region must be studied a bit at a time. And in each year of the course a certain proportion of the syllabus must be devoted to the study of the Home Region. It has to be woven into the syllabus so that it fits with the progression of geographical ideas and geographical skills, so that it is the back-ground of the whole syllabus from Class 3 to Form VI. The prescribing of a *detailed uniform* syllabus, particularly in the early stages of school Geography, inevitably kills the attempt to teach the Geography of the environment in a rational way. What we require is an outline syllabus emphasizing the general ideas to be taught, merely laying down the condition that the whole world should be covered at least once in the school course, and permit-

ting each school to design its own *teaching syllabus* in Geography up to Form IV. If we do this, if we try to encourage enthusiasm for the subject in the secondary training schools, guiding the Geography enthusiasts along the lines of practical and observational Geography, we shall soon begin to have little nucleii of good teaching centres, which will gradualy increase in size and influence, until in time the good work will permeate all the schools and the standard of Geography teaching will reach a plane which we know to be possible, although immeasurably high above our heads at the moment. And so this apparent set-back, which Geography has had, in being thrust out of the lime-light of the compulsory group, will, if we realise this opportunity of building anew, result in an improvement in the teaching of it and therefore develop its educational value as a subject in the curriculum. And meanwhile we shall have time to consolidate our position, and to strengthen our numbers before attacking the formidable obstacles that lie in the way of the development of the subject in University studies.

It is cheering to remember also that there are other factors working on the side of the protagonists of Geography. One of them is the increasing demand for geographical knowledge in present day life. Mackinder in a presidential speech to the Geographical Section of the British Association pointed out that it was not wholly by the initiative of the learned societies that the change came about in the higher study and teaching of Geography, but that it was due in no small degree to public demand. There is an amusing reference incidentally in that speech to his first lecture as University Reader in Geography at Oxford over 44 years ago : he had an audience of three, one man and two women. The man was a Don who told the young Geography Reader that he knew the Geography of Switzerland because he had just read the guide-book of that country from cover to cover ! The two women brought their knitting ! Nowadays there is developing an increasing number of occupations in which a knowledge of Geography is necessary and desirable—from the town-planner to the man in business. Geography is also one of the most useful of subjects in helping to develop the *international spirit*. We have only to look around us to see the importance that is being attached everywhere to the engendering of this attitude in schools, and also in grown-up communities. One of the most notable features to-day in education is the increasing number of organised visits of school-boys and school-girls to other parts of the world, all carried out by the teachers and the school authorities. From England

to Europe, to Asia, to America, and even Australia, parties of boys and girls set out every year ; and among the countries of Europe itself the systematic exchange of groups of boys and girls has developed to an amazing extent. The League of Nations has realised the importance of Geography in this respect, and has brought out a new pamphlet entitled "Geography Teaching in regard to World Citizenship". To the Geography teacher much in this pamphlet appears commonplace ; so little is new, simply because there has always been in the teaching of Geography this tendency to internationalism.

There are certain difficulties prevailing in this Presidency, which make improvement in the teaching of the subject impossible ; and it is the business of Geography enthusiasts to overcome them. One of these is *the dearth of attractive story books* with a geographical back-ground suitable for Indian boys and girls. I remember the joy I used to find as a school-girl reading the adventurous stories of Henty and Ballantyne, and a series entitled "The Three Midshipmen", "The Three Commanders", "The Three Admirals", describing the adventurous careers of the same three boys in the Royal Navy. These story-books carried one to all parts of the world, they thrilled with their sense of adventure, and they were invaluable aids to the learning of Geography out of school hours. Why can't you Geography students produce such story-books—all about Indians and their adventures in different parts of the world ? The material is there if you would only delve for it. What could be more thrilling than a tale of the "Pundit Explorers"—men of the Indian Survey who travelled in disguise in perilous hostile places, mapping secretly as they went ? "They would leave on their journeys and disappear sometimes for years, re-appearing unexpectedly with the geographical knowledge so laboriously collected. They counted their every step by the revolution of prayer wheels, or by the beads on their rosaries. At night they would write their notes on a roll of paper inside the prayer-wheel. They recorded compass bearings of mountains and rivers passed, by means of little compasses cleverly disguised as amulets worn round their necks. They carried boiling-point thermometers inside hollow walking sticks for the measurement of altitudes." Hari Ram and Kalian Singh and brave Kintup—they deserve to have their names perpetuated in thrilling story, and what a splendid geographical setting their adventures would make ! Why are there no stories rich in geographical detail of the early Hindu colonisers in Java and Angkor, of the Arab traders that made Peninsular India their highway from Canton to Basra ? A certain amount of re-

search, some attention to the form of the story, and a vivid and fairly accurate description of the dangers encountered and overcome—and you can produce a book that will be bought by every school. And incidentaly there is a lucrative career awaiting those of you with the gift for writing and the perseverance to study the geographical detail.

Another serious handicap is the lack of cheap large scale maps. Every secondary school should have a series of maps of the school locality on scales such as 80 inches to the mile, 20 inches to the mile and the one-inch map. Three maps of this type in England would cost under ten shillings. My estimate for three similar maps for the area round the Lady Willingdon Training College comes to Rs. 76 ! The trouble is that one has to buy from the Survey Department a complete set of maps because they are not sold separately—e.g., a complete set for the Mylapore division costs Rs. 48, while only one is required for the school's puropse. The prohibitive cost of maps, and for some places the lack of suitable maps makes it very difficult for teachers to teach *Home Geography* successfully. It is up to the Geography teachers, through the medium of the Geographical Association to prevail upon the Survey Office to consider the needs of the schools in regard to maps.

Another serious handicap is the kind of Geography text-books that is being poured on the market at present. There are dozens of text-books written by people who have hardly a bowing acquaintance with the aims and principles of Modern Geography, and who are certainly ignorant of the theory of the psychological approach to learning in the early stages of the school course. I am afraid these text-books will do a great deal of harm. Now that Geography takes a back seat again there is a hope that these hastily compiled text-books will stop appearing, and that we shall have more of the type of text modelled on the lines of the best Geography text-book writers like Leonard Brooks and " Fairgrieve and Young," written in the vernacular and carefully produced.

Let me in conclusion, quote a pertinent passage from an English essayist, C. A. Montague, as a warning to all Geography teachers and an incentive to text-book writers ! The occasion is a review of Mackinder's " Britain and the British Seas " :—

" Only now do many of us begin to see how well they kept from us at school the secret of the joy of finding how the earth

works. Some of us once had it and from them it was firmly taken away. They were born of the kind that pries young, asking when they play on sands, why there are tides, or what goes on in the sky that there should ever be rain. These are they that 'have to be plucked out of the earth' for lesson times, 'rank of the soil like roots' to learn from books what a bore their dear earth can be, with her strings of names of towns, rivers, and lakes, her mileages, her insufferable flax and jute. Pastors and masters are indomitable men, at least they were. To make large and gray book of fairy tales, the earth, dull and stale to a child importunately fingering at its covers was a task to daunt the strongest. They did it so well that many of their charges, if ever they had a hearty bite at these Eve's apples in the rest of their lives, only got it by accident. They may have been climbing the Alps and heard the unexpected detonation of a fall of rock crashing into the silence of the snowfields, and in that instant a whole range of fascinating fact was rescued from the triteness that had put a bar between it and their minds; for the first time they really knew how all night the frost had been driving its wedges into the granite of the peak till the sun came to draw them out, and send down the spitting stone, grinding itself to shale, to mix with the made earth in the valleys. They are in the very forge at last, with their own bodies shaken by a visible fall of the hammer at work in an unfinished world, and for the first time a living knowledge of these things rushes in upon their minds in a flooding miracle of enjoyment. To those who were taught in the old way the reading of a book like Mackinder's is a downright revelation. Geography was dry bones and behold! the dry bones stir; they give praise . . . . Everywhere you are captivated by some striking generalisation that seems as if by magic to shake into their right places whole masses of detached phenomena, easily fixing in position as normal details of larger wholes such seeming freaks as the lie of the rock at the top of Ben Lawers or the dots of coal in Ireland, the make of Portland Bill or the medley of tides in the Straits of Dover. To the middle-aged who parted with Geography in anger she comes again with rejoicing, bringing her sheaves with her".

Secondary School-Leaving Certificates 1934 Scheme

Group B.

Geography for Form IV.

Syllabus—A Geography of India.

I. *The World as a Globe.*

Location on the globe by means of latitude and longitude; and the world position of India. Determination of the latitude of a place by Pole Star and by the Sun. Longitude and time; local time and Indian standard time. (3)

II. *The Topographical Map.*

The meaning of scale; representation of relief by contours and typical contour forms; study of the 1″ map of the locality (in the field as well as in the class room.) (3)

III. *Rivers.*

The work of running water with special reference to the local stream or river; the typical course of a river; the chief rivers of India studied in relation to the relief, their courses, basins and relative importance. (2)

IV. *Rocks.*

Weathering and the formation of soil; the common rocks and soils of the locality and their common uses. Minerals and mineral oils in India—their distribution and economic uses. (2)

V. *Climate of India.*

The apparent migration of the sun; its cause and its effect upon temperature and length of day. Temperature conditions in India; the effect of altitude and proximity to the sea studied with reference to actual temperature graphs of characteristic places in India; temperature maps of India.

Rainfall conditions in India studied with reference to rainfall graphs for each of the characteristic rainfall regimes; causes and

types of Indian rainfall ; rainfall maps of India ; causes of the monsoons ; formation of cyclones in the Bay of Bengal. (4)

VI. *Natural Vegetation of India.*

Its distribution studied in relation to relief and rainfall ; forest areas and chief forest products. (1)

VII. *Irrigation.*

The water-table and well irrigation ; irrigation by means of rivers, flood and perennial irrigation. Irrigation systems of the Cauvery, Periyar, Indus and its tributaries, Upper Ganges. (2)

VIII. *Cultivated Crops.*

Distribution of local crops in relation to soil areas and availability of water ; the cultivated crops of India, their distribution and relative importance in each area. (2)

IX. *Distribution of Population.*

Study of the distribution of settlements as shown on the one-inch ordnance survey map of the locality ; the density of population in India in relation to relief and rainfall ; distribution of people in India as regards races, religions and languages. (2)

X. *A Detailed Study of each of the following Natural Regions of India :—*

(a) The Himalayas—their formation and characteristic zones of vegetation.

(b) The Indus Plains—their dependence upon irrigation.

(c) The Ganges and L. Brahmaputra Basin—the relation between rainfall and crops.

(d) Rajputana and Central India—a transitional zone.

(e) The Deccan—the lava region of the N. W. ; the N. E. region of the Upper Mahanadi and Chota Nagpur ; the Southern region of ragi and millet.

(f) The West Coast Region—the formation of its coast-line and backwaters.

(g) The East Coast Region and its deltas. (9)

XI. *Political Divisions of India.*

The Madras Presidency—its districts, towns and communications. Provinces and States of India—their boundaries in relation

to relief and natural regions, their capitals and inter-communications. (2)

XII. *Growth of Settlements.*

The chief sea-ports of India and their hinterlands. The chief industrial towns, nodal towns, religious centres and Hill stations of India. (2)

XIII. *The Trade of India.* (1)

B. World Studies.

XIV. Monsoon lands and the causes of their world distribution, with a study of China and Indo-China as a type of this region. (2)

XV. Equatorial forests and grass-lands and the causes of their world distribution, with a study of the Congo Basin and Anglo-Egyptian Soudan as types. (3)

XVI. Temperate forests and grass lands and the causes of their world distribution, with a study of the following types—Scandinavia, Denmark and the prairies of N. America. (4)

XVII. Mediterranean lands and the causes of their world distribution, with a study of Mediterranean Europe as a type (2)

XVIII. Deserts and the causes of their world distribution, with a study of Egpyt and the S. W. lands of Asia as types. (2)

XIX. The chief industrial regions of the world in relation to the supply of iron, coal, water power—a study of the industrial areas of Britain and Europe, U.S.A. (Lake Belt, Pennsylvania and New England States) and Japan. (7)

XX. *Lands of Indian Emigrants.*

Burma, Ceylon, Malaya, S. Africa, Kenya, British Guiana and Fiji. (2)

XXI. *World Routes.*

Ocean highways; trans-continental railway routes; air routes from India to Europe and Australia. (2)

XXII. *India's World Trade.* (1)

Total 60 lessons.

NOTE:—The figures in brackets suggest a distribution of lessons to each section, but it is not the intention that these must be strictly adhered to.

LIST OF BOOKS

S. S. L. C. Scheme—1934.

Form IV.—Geography Books Recommended

For Teachers :

The World About Us—Howarth—Oxford University Press.

Man and His Work by Herbertson, published by A. & C. Black.

Outdoor Geography by Hatch—Blackie & Sons—Rs. 2.

Surface of the Earth by Pickles, published by Cambridge University Press.

Provincial Geography of India.

Bengal, Behar and Orissa—L. S. S. D'Malley, published by Cambridge University Press.

Madras by Thurston, published by Cambridge University Press.

United Provinces by Sir J. Doine, published by Cambridge University Press.

Imperial Gazetteer of India—Vol. I, published by Oxford University Press.

India's Mineral Wealth by C. Brown, published by Oxford University Press.

Forests of India by Smythes, published by Oxford University Press.

A Class Book of Practical Geography by Young and Fairgrieve, published by G. Philip. Re. 1-12-0.

Experimental and Open Air Geography by A. Wilmore, published by Bell. Re. 1-4-0.

For Pupils :

I. Text-books : There is no one text-book at present which includes both parts of the syllabus—

1. Longman's Regional Geographies of India by L. Dudley Stamp, published by Longmans Green & Co., Pt. IV—Indian Empire—Rs. 1-8-0,

2. Geography for High School Classes by N. Subrahmanyam, published by The Indian Publishing House—Pt. 3—India.

3. Regions of the World, Book III by Barker and Brooks, published by The University of London Press.

II. *Practical Work* :

(a) Survey of India map, scale 1″ to 1 mile of the Home Region (to be selected from the Survey of India Catalogue of 1″ maps) price unmounted Re. 1-8-0 each.

Note :—Every school should have the one-inch map of its own home region because this is the reference for all the local geography taken in the school course. It is desirable there should be at least 1 map to every two pupils in Form IV ; it might be possible for school to supply the requisite number, recovering the cost over a period of years, by charging each pupil using these maps a small fraction of the cost.

(b) Longman's Geographical Exercise Book for India by D. & E. Stamp, published by Longman's Green & Co.,
Pt. I—Map Reading Exercises, As. 12.
Pt. II—Climatic Exercises, As. 12.
Pt. III—Graphical & Regional Exercises, As. 12.

III. *Atlases* :

(a) Longman's Senior Atlas for India, edited by G. Philip, published by Longmans Green & Co., Rs. 2.

(b) The Taj Mahal Atlas by G. Philip, published by Longmans Green & Co., Re. 1-5-6.

(c) The Indian School Atlas, edited by G. Bartholomew, new and revised edition, published by The Oxford University Press.

IV. *Pupil's Reference Library* :

(1) Man and His Work by Herbertson, published by A. & C. Black.

(2) World Communication by Land and Sea and Ocean by Sweeting, published by Nisbet, Rs. 2.

(3) The World at Work by H. R. Sweeting, published by Nisbet, Rs. 2.

S. S. L. C. 1934 SCHEME

Group C.—Geography Syllabus.

1. A regional study of the world aiming at the knowledge and application of fundamental principles rather than an accumulation of detailed information about various regions.

2. A detailed regional study of a special region outside India, to be prescribed each year. This will be either a major natural region or an important country.

3. A detailed study of the local area (approximately an area of not more than 10 miles radius from the school). Opportunity should be afforded for direct observation and practical work in the field, and the emphasis should be placed upon the influence of the physical factors upon the life and activities of the people.

N. B.—It will be assumed in setting the papers that practical work has been done along the following lines: Weather observations and records and their representation; elementary map making by chain survey; map-reading including all varieties of maps and the drawing of sections; construction of diagrams, etc., from data; observation (in the field) of effects of weathering and the work of running water.

S. S. L. C. SCHEME, 1934: LIST OF BOOKS

Geography Books Recommended for Group C.

For Pupils:

I Text-Books:

A Geography of the World by Howarth & Bridewell, published by Oxford University Press.

The New Regional Geographies by L. Brooks, published by University of London Press, Bk. IV., The World.

The World—a General Geography for India Schools, by Dudley Stamp, published by Longmans Green & Co., Rs. 3.

II. Atlas:

Longman's Senior Atlas for India, edited by G. Philip, published by Longmans Green & Co., Rs. 2.

III. Reference :

The Rambler Travel Books, edited by L. Marsh, published by Blackie & Sons.

For Teachers : *Reference* :

An Intermediate Geography of the World by D. Stamp, published by Longmans Green & Co.

A Class Book of Practical Geography by J. Fairgrieve, published by G. Philip & Sons.

Practical Geography by Unstead, published by Oxford University Press.

Outlines of Physiography by Herbertson, Oxford University Press.

Principles and Practice of Geography Teaching by Barnard, published by University Tutorial Press, Rs. 3-8-0.

Practical Geography by Unstead, published by Oxford University Press.

An Experimental Geography by Wilmore, published by Bell, Re. 1-4-0.

A Graded Course of Geography by E. S. Price, published by G. Philip, Books. I—IV (Excellent for method)

Hints and Comments on the IVth Form Syllabus in Geography

BY

MR. N. SUBRAHMANYAM, M.A.L.T., F.R.G.S.

There may be a good deal of difference of opinion between the advocates of compulsion and of option regarding the proper place of Geography in the High School curriculum. But we do not propose to discuss that question now; but, accepting the position accorded to it in the present scheme, we proceed to explain and comment upon the aims and ideas behind it and to give suggestive notes as to the right ways of handling it.

This syllabus seems to have been prepared with three aims in view, namely: (1) to serve as a coping stone for Middle School Geography rounding off that course; (2) to serve as a purposeful course, useful in later life for the bulk of the pupils who will naturally drop the subject in the Vth and VIth Forms, if they happen to specialise in some other subjects, and for whom it will be the last Geography; and (3) incidentally to serve as the basis of specialised work for those pupils who take Geography as an option in the Vth and VIth Forms.

These three aims are attempted to be achieved by including in the course (1) the Geography of the mother-country, (2) with principles of World Geography interwoven and applied therein as work for two terms; and (3) World Studies, to serve as a complement to (1) and (2) as work for the third term.

At present the Geography of India is learnt descriptively in rather a meagre outline way usually in the First Form, owing to the inability of the pupils at that age to comprehend the correlation of the various geographical factors concerned in the study. In the first three forms at the same time the regional geography of the world is gone through, when necessarily the several principles of world geography are learnt concretely and inductively. To round off this world study it is now desirable to learn at least in the IVth Form the Geography of India more thoroughly than was possible in the 1st Form and with a better comprehension of

the underlying principles which have been learnt concretely in connection with the regional study of the continents in the lower forms. These principles are now not only incidentally revised, but their significance is more fully comprehended as they are linked with the personal knowledge and experience of the Geography of the Home Land and the Home Region. Hence, the very important innovation in this syllabus of emphasising the Geography of the Home Region. No doubt a teacher of Geography, who has been properly trained in the pedagogy of the subject, knows that the Home Area is *the laboratory of direct geographical observation,* and would correlate the study of Geography with that area as often as possible, whether it is so mentioned in the syllabus or not. But, because in the actual handling of the subject, this elementary principle of teaching has so often been lost sight of, it has been found necessary to put into the syllabus points for direct observational study in the Home Region; and the one-inch map of the home area of the school has been introduced as an indispensable aid in this study. Hence, the Geography of the Home Country and of the Home Region are interwoven with the principles of Geography. It is needless to say that the teaching methods should be practical as far as possible, and that plenty of practical exercises given to the pupils in the course of the teaching.

The second part of the syllabus, which is to be done in the 3rd term, contains for the most part studies of the major natural regions of the world in rather a selective way as a compromise for want of time. The distribution of each of the regions with the causes of such distribution is first learnt; and this is followed by a detailed study of the most typical or the most significant example of that region. After the selected regional studies are finished. the following three topics—Lands of the Indian Emigrants, the World Routes and India's World Trade—round off the work of the year by linking the first and second parts together.

Let us next pass in review the several topics in the syllabus, and give a sort of a running commentary on some of them, suggesting the proper way of handling them.

I. *The World as a Globe.*—Under this head the one topic that may be considered somewhat tough is the determination of the latitude of a place from the sun. It has been tried in the class and found to be easily intelligible for the pupils, if the proper approach and sequence are followed. Their personal knowledge

from experience of the sun's apparent path in the sky at mid-day in the different seasons should be recalled and expressed diagrammatically ; and the place chosen may preferably be the locality of the school. The geometry involved in the diagram is very simple and elementary, and already known to the pupils. The following sequence of cases is suggested as being properly graded : (a) pole star case, (b) sun at the equinoxes (treated as the converse of the former case), (c) sun south of the equator, (d) sun north of the equator but south of the place, and (e) sun north of the equator and north of the place. This order may be usefully adopted for any school in South India, which lies between the Equator and the Tropic of Cancer. Two periods should more than suffice for this topic ; and one period may be given for the rest of the points under 1, most of which would already be known to the boys ; and it is only a question of gathering together.

II. *The Topographical Map.*—The idea of scale is also nothing new ; and boys may be shown maps of different scales and given a few exercises thereon such as finding distances between places, etc. The conception of *contour* is basic in the study of relief. The frequent and earlier use of the colour relief map obscures the existence of contours in it ; and colour is often thought to be of the essence. This wrong notion should be corrected, for example, by getting the pupils to appreciate the topography of a contoured area first, and then colour the same approximately, when the contour will be found to be the boundary between any two adjacent colours.

The one-inch map of the locality is a mine of useful and accurate information ; and its use cannot be too strongly recommended in field study along with observational work. It should be a matter of pride for every pupil to own his own copy of the one-inch map of the home area, as he does his own atlas or dictionary.

III. *Rivers.*—This section does not call for any remark except to state that the field study of the local stream may usefully be accompanied by the use of the one-inch mhp.

IV. *Rocks.*—Under this head the relative importance of the productive areas of the minerals may be brought out by statistical comparison and preferably by diagrammatic representation also.

V. *Climate of India.* Here plenty of practical exercises on maps and graphs may be given. The inclusion of 'cyclones in the Bay of Bengal' has been misunderstood by some teachers. It is not

expected that the boys should know thoroughly the physical geography of cyclones. But they are to have a working knowledge with some understanding of the underlying principle of what is such a familiar phenomenon in South India within their everyday experience. It would be a pity if they do not get an elementary knowledge of how, under what conditions and in what seasons they are formed in the Bay of Bengal, and how they cross the coast and the peninsula, giving usually general rainfall and sometimes causing destruction of varying degree especially to places near the coast along their track.

VI. *Natural Vegetation of India.* Under this head, the types of forests according to the amount of rainfall as well as the change of vegetation with altitude should be brought out. There is also what is technically a forest with 'R. F.' boundary pillars erected in a dry scrub jungle area under the jurisdiction of the forest department. Though marked green on the one-inch map, its true nature should be explained to the pupils from local examples. The use of the forest for the agriculturist by supplying leaf manure and affording grazing grounds should not be lost sight of.

VII. *Irrigation.* The local irrigational methods should obviously form the basis of study; and here again the one-inch map may be correlated with observation on the field.

VIII. *Cultivated Crops.*—Here the cycle of crops in the same field in relation to the seasons should also be noted in addition to their general distribution according to level and availability of water. The importance of slope control, which reduces itself to moisture control, of crops may be explained in the field.

With regard to the crops of India, there may be some preliminary indication here as to which of the crops are mostly locally consumed (for example, millets) and which are largely exported (for example, wheat) and whereto, though this aspect will be studied fully later on under 'Trade of India'.

IX. *Distribution of Population.*—The most impressive method of bringing home to the pupil the relative distribution of population in the home area is to observe the country round from an eminence, and compare the idea thus obtained with what is indicated on the one-inch map. For India the population map is the basis of study; but statistical comparisons will be found interesting.

X. *The Regional study* under each of the seven heads would of course include a correlated study of the crops and industries of the several regions along with the physical conditions of surface, soils, climate, etc. The characteristic and peculiar features, physical and human, of each of these regions should be fully brought out, and compared and contrasted wherever possible. Sketch-maps should be freely used in this connection.

XI. *Political Divisions.*—A more detailed knowledge of South India is expected than of the rest of India for obvious reasons.

XII. *Growth of Settlements.*—The relative importance of the several chief towns should be brought out by means of population figures. The relative size of the towns can be represented on a population map by appropriate symbols.

XIII. *The Trade of India.*—Regarding the chief imports and exports the use of bar, circular and other diagrammatic methods of representation are recommended in order to bring out the relative importance of the different commodities as well as the areas of supply and the markets.

B. *World Studies.*—Here under each natural region the first lesson can be usefully taught on a world map, showing the distribution of the particular region; and in the following one or two lessons the region chosen for special study should have its type characteristics brought out. Special care has been taken to see that the important countries of the modern world are included so that a proper world outlook may be obtained by the pupil. In studying about the advanced foreign countries, it is desirable to show the contrasts with the home land so that the pupils may be inspired with a feeling and knowledge as to the directions in which improvements are needed in the latter by the application of scientific knowledge and capital.

XX. *Lands of Indian Emigrants.*—For this topic the teacher may have to collect material from journals and newspapers also; and pupils may be given occasional readings from the newspaper.

XXI. *World Routes.*—Advertisements of shipping and railway companies and newspaper clippings for up-to-date information about airways may be found useful.

XXII. *India's World Trade.*—Statistical comparisons with diagrammatic representation would be found helpful for proper appreciation of India's position in this respect.

In conclusion, we wish to state again that the syllabus is a purposeful one, and can be expected to be of service to give a citizen's training both from the national and the international point of view. Possibly it may be considered ambitious and heavy. It need not be so, if time is not unduly wasted over certain items and the perspective of the syllabus is kept in view with proper allotment of time to the several topics. It should be remembered that many of the facts and principles are already known to the pupils, having been learnt in their study of Geography in the lower forms, and that they are brought together here for the sake of systematic treatment. It is hoped that teachers will give it a fair trial and not try to scrap it with a prejudice. In the light of experience, there is always time to make necessary changes and alterations. The facts that Geography is a B. Group subject should be taken advantage of not to neglect it. On the other hand, it should be welcomed as an opportunity for making experiments and striking out new paths, free from the trammels of an external examination, taking into account the teacher's special tastes and the peculiar advantages of each local environment. The Editor of the Journal will be glad to publish answers to queries regarding the right treatment of any particular topic in the syllabus.

Report of the Tiruvallur Regional Survey Committee

The Tiruvallur Regional Survey Committee appointed by the general body at the last annual meeting held on 27-4-1933 has the honour to submit the following report:—

Though the members of the committee met formally on 27-4-33 before the general body meeting and their appointment as a committee and discussed several important points regarding the regional survey of Tiruvallur, nothing appreciable could be done during the next two months as the members had broken up from Madras owing to the Summer Vacation.

After the reopening of the Colleges, the committee met for the first time on the 15th July 1933 when after a full discussion of the methods and ways and means regarding the survey in question, it was resolved (a) to stick to the Tiruvallur area for the first model survey (b) to recommend to the working council the employment of Mr. V. Krishnan, M.A., till September 1933 on a suitable salary and (c) to entrust him with the work of collecting as much preliminary information and materials as possible as well as to find out all the available sources of such informaion regarding the Tiruvallur area. Mr. V. Krishnan was accordingly appointed on a monthly salary of Rs. 50 with a monthly allowance of Rs. 25 towards travelling expenses; and the secretary was authorised to purchase maps, books and other materials required by Mr. Krishnan for carrying on his work.

The second meeting of the committee was held on 29-7-33 after Mr. Krishnan had been at work for a fortnight, and a discussion took place regarding the kind of data to be collected and the maps to be prepared; as a result of which instructions and guidance were given to Mr. Krishnan, who was also present at the meeting. The following were the maps that were considered necessary to be prepared in the first instance:—(1) Surface utilisation map, (ii) map of hydro-graphic conditions (Surface and underground) :. (iii) Relief map with contours and showing drainage on 8″ scale, and, (iv) soil survey map.

On 6-8-1933 all the members of the committee visited the village of Tannirkulam 3 miles east of Tiruvallur, to see and check

the work of Mr. Krishnan on the spot. They were received at the village by Dr. S. Dakshinamurthy, Secretary of the Tiruvallur Rural Reconstruction Committee and by Mr. J. F. Kendrick, Representative of the Rockfeller Foundation Trust, who explained the scope and programme that had been envisaged in their scheme.

On 10-8-33, the Committee met for the third time, when it was decided (1) that Mr. T. N. Muthuswamy should guide Mr. Krishnan in the matter of soil study, (2) that item 20 of village returns (concerning rainfall figures) should be checked and collected for as many villages as possible within the area, (3) that the one inch map should be enlarged to double the size, utilising the services of the draftsman and overseer of the T. R. R. Committee, and (5) that land utilisation maps should be prepared for the other type villages as for Tannirkulam.

The fourth meeting of the committee was held on 26-8-33, when Miss K. S. Ranga Rao was co-opted as a member of it. As regards the preparation of rainfall maps, it was decided that three seasonal and one annual maps should be prepared for the area; and as for the contour map, it was decided that a few spot heights of the one inch map should first be tested by the aneroid barometer, and then a few more heights determined to enable contours to be drawn at intervals of 25 feet.

On 10-9-33 Messrs. N. Subrahmanyam and T. N. Muthuswamy went to Tiruvallur with Mr. V. Krishnan and tested the chief spot heights along the Poonamallee—Tiruvallur—Red Hills Roads, and found that the method of fixing the spot heights with the help of the aneroid barometer was quite reliable and feasible.

On 1-11-33 a letter was received from Mr. George Kuriyan, stating that Mr. V. Krishnan, who had been working under the Committee, was awarded a University Research Studentship for working at the Regional Survey of Tiruvallur under his guidance. The work of the Committee *ipso facto* came to a close.

The Committee was consequently called to meet on 4-11-33 to review the work so far done and to decide its position. It was resolved to call upon Mr. Krishnan to submit all his work so far done with a Report thereon, and to circulate the same to the members of the Committee.

This Report was accordingly circulated to the members of the Committee along with the maps and statistics prepared and collected by Mr. Krishnan; and these will be preserved in the office for future reference and further work.

The total expenses incurred in connection with the work came to about Rs. 200, (including the cost of books and maps), the main item of expenditure being the stipend to Mr. Krishnan amounting to Rs. 187-8-0.

N. SUBRAHMANYAM.
Convenor.

To,
The Secretary,
Madras Geographical Association
Gopalapuram.

From,
V. Krishnan, M.A., Dip. Econ., Dip. Geo.,
Regional Survey, Tiruvellore.

Sir,

I have the honour to submit my report on the Regional Survey, I have been doing, in the Rural Development Scheme area in the Tiruvellore taluk, Chingleput District.

From the 16th of July 1933 till the 31st July I was mainly engaged, partly in Madras and partly in Tiruvellore, in the matter of looking up the various references and sources of information available, so that a definite line of action can be taken as regards the Survey.

In the second stage the village of Thannirkulam was taken and an intensive survey was made of that village and the maps given in the Appendix were prepared and submitted to the members of the Committee when they visited Thannirkulam about the middle of August.

In the light of the experience gained at Thannirkulam, I proceeded to collect the information available both in taluk office and by actual field work. The result of that is given in the appendix in the form of classified statements.

An intensive tour was undertaken by me from about the 20th of August till the 27th of September. About one-third of the area was covered during that period. The data collected during that time is also given in the Appendix. Various difficulties had to be encountered in the matter of the collection of data ; for the accounts as kept in the villages are not uniform, since in this tract Shotrium, Zamindari, Inam and Ryotwari villages are side by side. Some of the Zamindari and Shotrium villages have not been surveyed as yet and difficulty was found to locate various points for soil, crop and water table maps. They do not keep regular crop Registers and Rainfall accounts. Another difficulty was at the time of the visit in some of the villages when the authorities (Karnam and village munsiffs) were not available and so all the required materials could not be got at one visit. A third difficulty was that some of the accounts were sent to the Taluk Office and hence they were not available. So even in the data collected there may be some gaps which have to be filled in by further enquiry.

On the basis of such insufficient data I have not ventured to establish correlations between one factor and another and only give below the bare statistics in a tabulated form.

I have the honour to remain,
Sir,
Yours sincerely,
V. KRISHNAN.

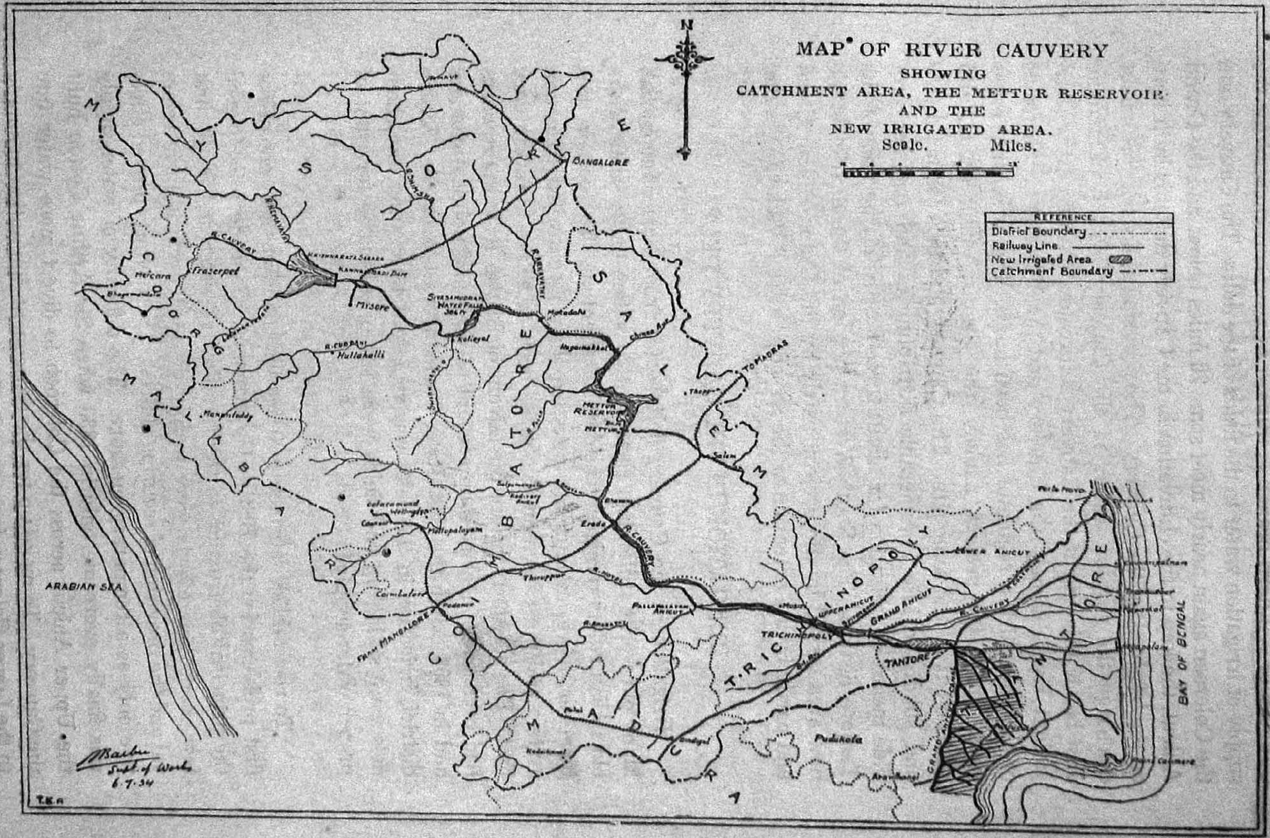
The Mettur Dam

EVOLUTION OF THE SCHEME

The river Cauvery rises in the Western Ghauts near Mercara in Coorg, at an elevation of 4,400 feet above sea level, and after a course of nearly 500 miles, enters the Bay of Bengal, draining an area of 31,000 square miles *en route.* The Western Ghauts are subject to heavy rainfall during the South-West monsoon and the highest run-off usually occurs in July or early in August. The Mysore plateau which drains into the middle reaches of the river is subject to fluctuating rains during the months of August to October. The important tributaries which join the Cauvery in this reach are the Hemavathi, the Lakshmanathirtha and the Kabini, which also take their rise in the Western Ghauts. After leaving the Mysore plateau, the Cauvery winds its way through hilly country and the Mettur Dam is constructed in a gorge where the river enters the plains. From this point downwards the catchment is subject to the North-East monsoon rains and the high floods due to this monsoon usually occur in November. The Bhavani, the Amaravathi and the Noyel are the chief tributaries joining the river in this reach though the first two in their upper reaches are under the influence of the South-West monsoon rains as well. This sequence of rainfall conduces to a fairly high flow during the irrigation season from June to January except for a short period of about six weeks when there is a break in the monsoon. While the South-West monsoon supply is copious and dependable, the North-East monsoon supply is irregular and frequently fails. The caprices of this monsoon have frequently affected, sometimes very seriously, the cultivation in the Cauvery Delta and the chief aim of the Cauvery-Mettur system is to remedy this state of affairs by storing the waters of the surplus floods in the South-West monsoon and distributing them evenly throughout the succeeding irrigation period.

THE CAUVERY DELTA

The head of the Cauvery delta is at the Upper Anicut, 10 miles west of Trichinopoly. Here the river bifurcates into two large branches, of which the northern takes the name of Coleroon and the southern retains that of Cauvery. A regulator spans the Coleroon at the Upper Anicut. The Coleroon is really the main channel of



MAP OF RIVER CAUVERY
SHOWING
CATCHMENT AREA, THE METTUR RESERVOIR
AND THE
NEW IRRIGATED AREA.
Scale. Miles.
N
REFERENCE
District Boundary
Railway Line
New Irrigated Area
Catchment Boundary
MYSORE
BANGALORE
COORG
Mercara
Frazerpet
Mysore
Hullahalli
MALABAR
Manantoddy
ARABIAN SEA
COIMBATORE
Ootacamund
Wellington
Mettupalayam
Coimbatore
Podanur
From MANGALORE
Kollegal
METTUR RESERVOIR
METTUR
SALEM
Salem
TO MADRAS
Erode
Bhavani
R. CAUVERY
TRICHINOPOLY
UPPER ANICUT
GRAND ANICUT
LOWER ANICUT
TANJORE
Pudukota
MADURA
Dindigul
Palni
Porto Novo
BAY OF BENGAL
Negapatam
Point Calimere
Aranthangi
Mathu
Supt. of Works
6.7.34

Fig. 1.

the river and carries the bulk of the flood-waters to the sea. The Cauvery or southern branch is utilised as the main channel for the supply of irrigation water to the fields of the delta. The Cauvery and the Coleroon again nearly meet some 20 miles below, and the Grand Anicut, the key to the cultivation in the Cauvery delta, is built here on the left bank of the Cauvery. The scouring sluices at this anicut discharge the surplus waters of the Cauvery into the Coleroon. Just below this anicut the Cauvery bifurcates into two main (irrigation) rivers namely the Cauvery and the Vennar, at the heads of each of which a regulator has been built. The new canal excavated under the project, namely, the Grand Anicut Canal, also takes off from the same site. The Cauvery and the Vennar divide and subdivide into innumerable distributaries and together provide means of irrigation for about three-fourths of the area of the Tanjore district. The South-Western portion of the district is the new area served by the project, partly by the Grand Anicut Canal and partly by the extension of the already existing Vadavar system.

IRRIGATION IN THE CAUVERY DELTA

Irrigation in the Cauvery delta dates from time immemorial. Many old works still extant show that irrigation under some of the old Indian rulers received considerable attention. The system was, however, more an inundation system than a controlled irrigation system and must have on this score been defective from the very first. For a century before the advent of British Rule these works had been badly neglected on account of wars and political changes and in 1801, when the East India Company took over the Tanjore district, irrigation in the delta was rapidly deteriorating, the channels were silting up and fields were left uncultivated for want of proper water-supply.

To re-establish satisfactory irrigation conditions was one of the first problems for the British Government. Sand deposits formed the principal obstruction to the free flow of water and in the first few years their efforts were mainly directed towards their removal and the provision of scouring sluices. These efforts proved effective only as a temporary measure. The difficulty of water-supply was finally overcome only in 1836 when Sir Arthur Cotton built the Upper Anicut across the Coleroon to divert more water into the Cauvery. To make up for the consequent diminution in supply to the Lower Coleroon irrigation the Lower Anicut (70 miles below Grand Anicut) was also built across the Coleroon. But the supply

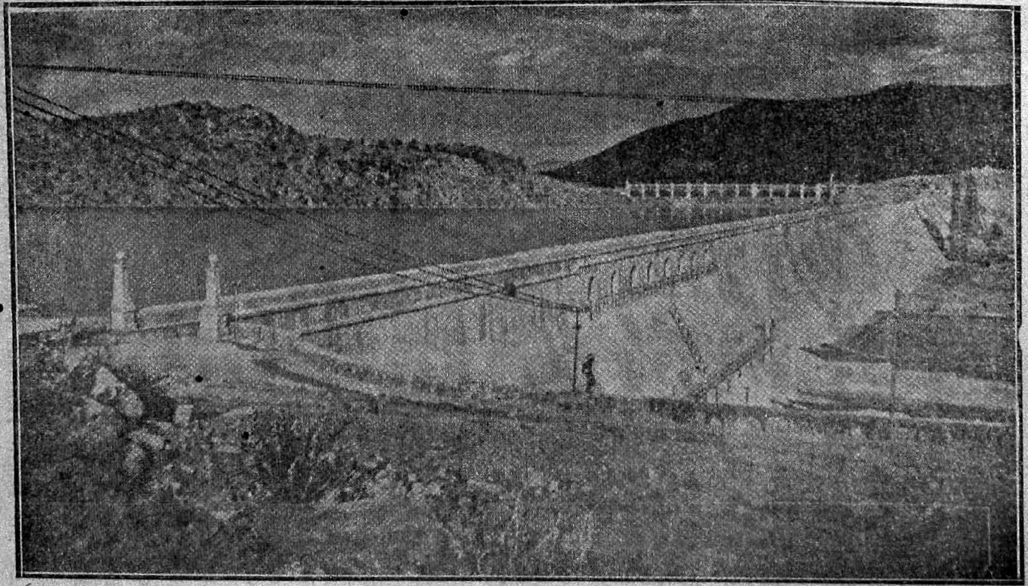


Fig. 2. The Mettur Dam.

in the Cauvery during floods now became too great to be controlled and began to cause serious damages to the bed and banks of the Cauvery. To check this tendency, a grade wall called the Cauvery Dam was built in 1845 across the Cauvery at the Upper Anicut. Further improvements followed, the most important of these being the construction of the regulator across the Cauvery and the Vennar at the Grand Anicut, the cutting down of the crests of the Upper and Lower Anicuts and the provision of lift shutters at these anicuts capable of holding up 2 feet extra supply for the benefit of irrigation, and the construction of regulators across the various rivers at the sites of all the important off-takes in the delta.

INCEPTION OF STORAGE AND ITS EVOLUTION

These improvements made the distribution of water-supply more systematic by placing under complete control whatever quantity of water was available at the Upper Anicut, but there still remained the defect of highly fluctuating supplies with long spells of drought, to be got over. A storage reservoir of a size that could help the delta to tide over the spells of drought by storing the surpluses when available was the obvious solution and the Mettur Dam is the result. " Storage " as a means of permanent improvement of irrigation supplies was conceived well over a century ago but the size of the reservoir, and its location were subjects of a long controversy which centred about the relative merits of a small reservoir on the Bhavani or a large one on the Cauvery. It was finally settled in favour of a large one on the Cauvery, and a carefully designed scheme, which has just been carried out to a finish with slight modifications, was submitted by Col. Ellis in 1910. The execution of this Project was held up on account of a long dispute with Mysore Government regarding the division of the surplus waters of the Cauvery. As soon as a workable agreement was arrived at with Mysore, the Project estimate was revised in 1924 and submitted to the Secretary of State shortly after, and the execution of the scheme was started on 20th July 1925, when the first blast was made in the presence of His Excellency the Right Hon'ble Viscount Goschen, then Governor of Madras. An Obelisk near the Right Flank of the Dam commemorates the inauguration of the present scheme.

PRESENT SCHEME

The Project, as designed, provides for a 60 square miles lake impounding 93,500 million cubic feet of water at Mettur,

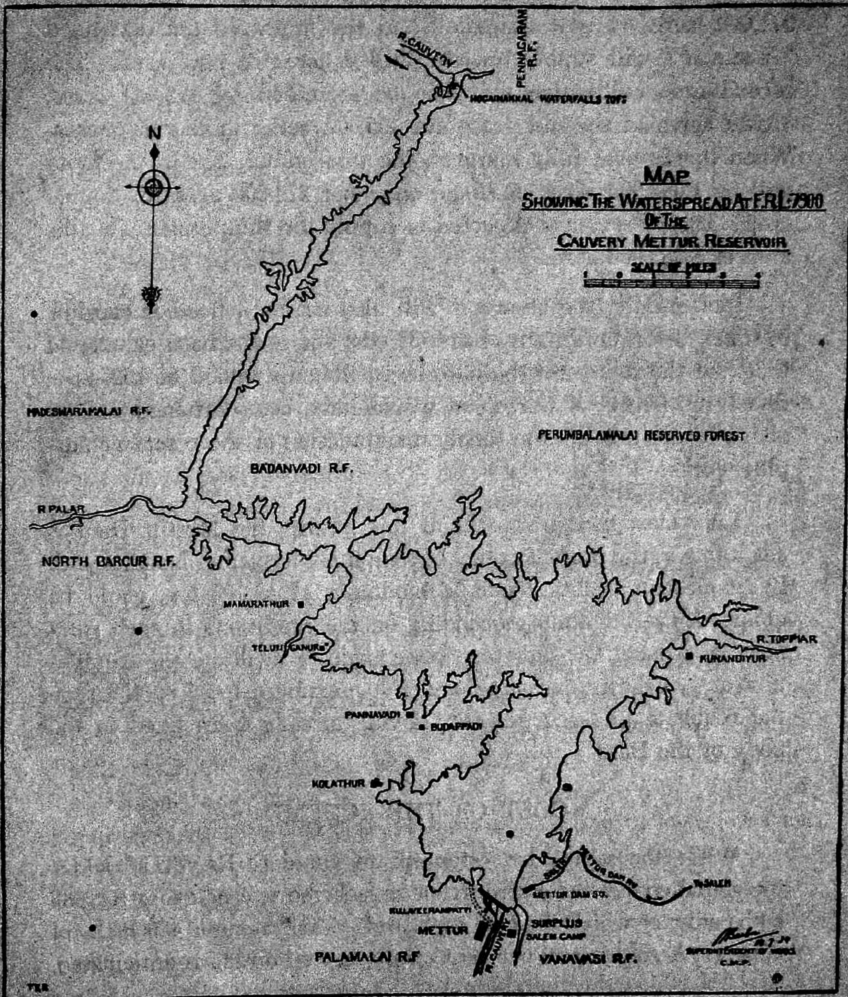

MAP
SHOWING THE WATERSPREAD AT F.R.L. 7900
OF THE
CAUVERY METTUR RESERVOIR
SCALE OF MILES
N
R. CAUVERY
PENNAGARAM R.F.
WATERFALLS
MADESWARAMALAI R.F.
PERUMBALAMALAI RESERVED FOREST
BADANVADI R.F.
R PALAR
NORTH BARGUR R.F.
MAMARATHUR
R. TOPPIAR
KUNANDIYUR
PANNAVADI
BUDAPPADI
KOLATHUR
METTUR DAM RY.
To SALEM
METTUR DAM STN.
METTUR
SURPLUS
SALEM CAMP
R. CAUVERY
PALAMALAI R.F
VANAVASI R.F.
SUPERINTENDENT OF WORKS
C.M.P.

Fig. 3.

The Dam is 5,300 feet long and contains 54.6 million cubic feet of masonry. The reservoir backs up 33 miles to the foot of the 70-feet high Hogankal Falls which become partly submerged. A new canal, the Grand Anicut Canal, with a capacity of 4,200 cusecs, has also been excavated to supply ultimately an extent of 271,000, acres of new irrigation and the improved and extended "Vadavar" will supply another 30,000 acres of new area. The second crop cultivation will also be increased by 175,000 acres, 70,000 acres in the old area and 105,000 acres in the new area. When the Project fully matures, the total cultivation in the delta will be 1,082,000 acres of single crop and 270,000 acres of double crop. The reservoir is expected to supply the requirements of this area of 1,352,000 acres.

Incidentally, the reservoir will also act as a flood moderator in times of extraordinarily heavy floods, and it has been calculated that had the dam been built prior to the super-flood of 1924, the disastrous effects of that flood would have been flattened out by about 15 per cent by the timely manipulation of the reservoir surplus works.

Like most modern works of this nature, the Mettur Dam is adaptable to the present policy of combining irrigation benefits with hydro-electric facilities, and a maximum of 49,000 h.p. could be obtained, the minimum depending on the conditions in each summer. Provision has therefore been made to facilitate the installation of 4 turbines operating under a maximum head of 150 feet, the requisite intake pipes etc., having already been fixed in the body of the Dam.

COST OF THE SCHEME

While the sanctioned estimate amounted to Rs. 737.08 lakhs, the actual cost of the entire irrigation scheme will be about Rs. 680 lakhs only, of which the cost of "Headworks" alone is 480 lakhs of rupees. A return of 6 per cent on the capital outlay is anticipated.

This Dam is believed to be the largest already constructed and the second largest including those under construction. The present design of the Dam also provides for its height being raised by 10 feet at some distant date to compensate for the silting up of the reservoir bed by providing for an extra capacity of 17,500 m. c. ft.

The main particulars of the dam are furnished below in the tabular statement:

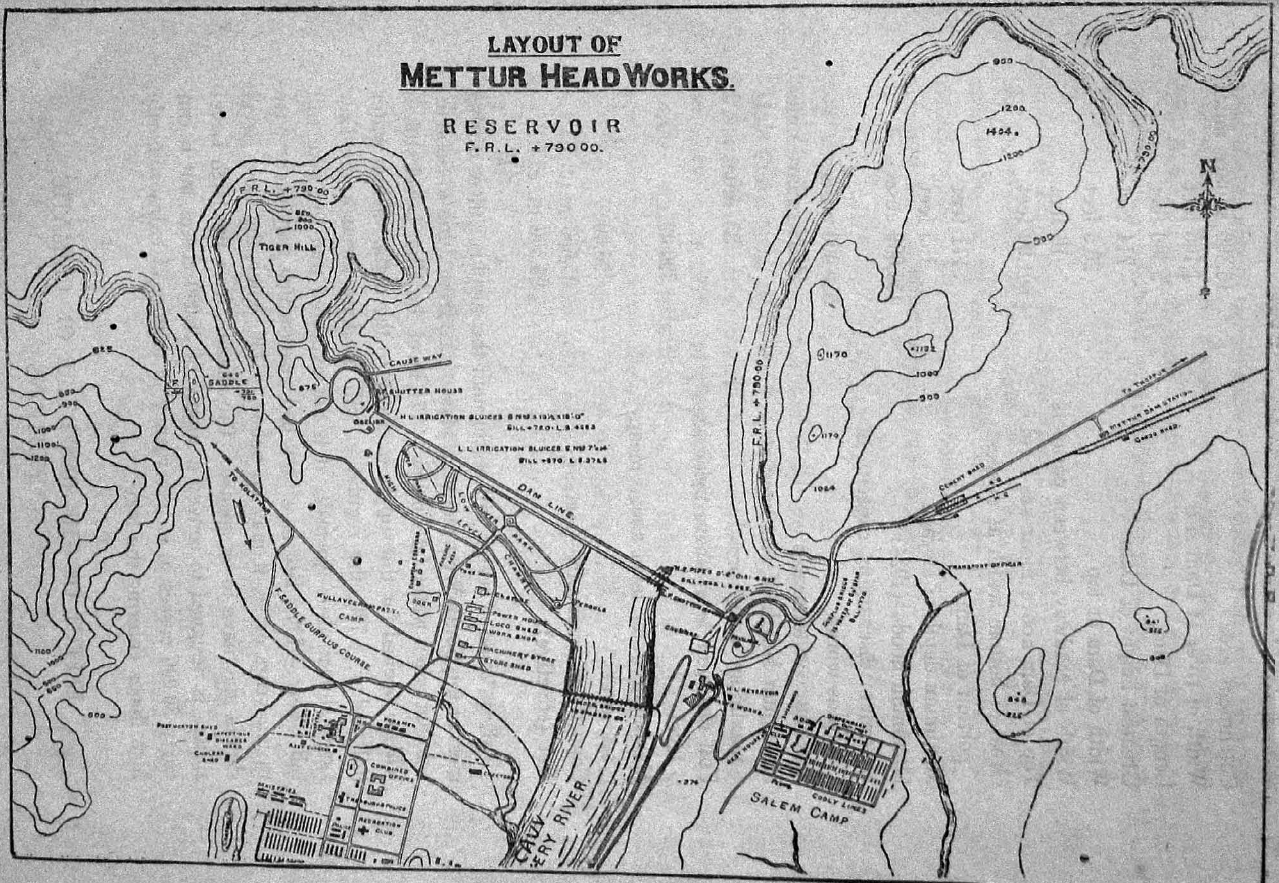

LAYOUT OF
METTUR HEADWORKS.
RESERVOIR
F.R.L. +790·00.
F.R.L. +790·00
TIGER HILL
CAUSE WAY
SADDLE
SHUTTER HOUSE
H.L. IRRIGATION SLUICES
L.L. IRRIGATION SLUICES
DAM LINE
TO KOLATHUR
LOW LEVEL
CHANNEL
PARK
KULLAVEERAMPATTY CAMP
F. SADDLE SURPLUS COURSE
POWER HOUSE
LOCO SHED
WORK SHOP
MACHINERY STORE
STORE SHED
COMBINED OFFICE
RECREATION CLUB
CAUVERY RIVER.
SALEM CAMP
COOLY LINES
DISPENSARY
TRANSPORT OFFICER
CEMENT SHED
METTUR DAM STATION
TO TORPUR
N
1454
1200
900
1170
1132
1000
1064

Fig. 4.

PARTICULARS OF DAM

Catchment area	16,300 square miles
Width of river at Dam site	1,100 feet
Length of Dam	5,300 feet
Greatest height of Dam	214 feet
Width of Dam at top	20.5 feet
Width of roadway between parapets	16 feet
Top of Dam above mean-sea-level	+801.00 feet
Greatest bottom width at deepest portion of Dam	171 feet
Maximum depth of storage	165 feet
Maximum floods (1924)	456,000 cusecs.
Maximum discharging capacity of surplus works	550,000 cusecs.
Maximum waterspread	59.25 square miles
Maximum length of reservoir at maximum waterspread	33 miles
Full reservoir level above mean-sea level	+790.00
Maximum water level above mean-sea-level	+796.00
Capacity of reservoir:—Gross	95,660 m. c. ft.
Net (effective)	93,500 m. c. ft.

Regulation of water will be through the surplus sluices during most of the South-West monsoon season, i.e., from June to September, but when water falls below +774 level the High Level sluices will be opened for the supply of water to the delta. When water falls below +730, the regulation will be done through the Low Level sluices also. Normally it is not expected that the lake will fall below +735. But in a very bad year, which may occur once in ten years or so, it may go below + 730, when the Low Level sluices may have to be opened. The channel from the High Level sluices is designed to convey a supply of 25,000 cusecs but it can carry 30,000 cusecs in an emergency to dispose of extraordinarily high floods entering the lake.

EFFECT OF THE RESERVOIR ON CLIMATIC CONDITIONS

This reservoir with its extensive water-spread, is sure to have its effect on the surrounding country. It is too early yet to say de-

finitely what the effect would be. However, it is found even now that the maximum temperature during summer shows a tendency to decrease, while the humidity of the air is undoubtedly higher. The rock on which the dam is founded is so sound that there is no apparent rise in sub-soil water level in the valley below the Dam-site.

It is likely that the prevalence of malaria may increase owing to the presence of vast areas of shallow water at the margins, which have a total length of 180 miles. The presence, however, of swarms of larvicidal fish which already inhabit the shallow margins of the lake may effectively mitigate this danger.

THE CANAL SYSTEM

The Canal system is situated in the Tanjore District. The Main Canal takes off at the Grand Anicut just above the Cauvery-Vennar regulators at the right side. Work on the Canal system was started in 1926 and a good portion of the Canal has been thrown open for irrigation from the season of 1933. Owing to some controversy about the exact location of the area which should otherwise have come under the tail-end reach of the Grand Anicut Canal, there has been some delay in starting the work at the tail-end. It is expected that all the canal works will be completed in 1935.

DETAILS OF THE AREA TO BE IRRIGATED

Old Delta

	acres.
Single crop	886,000
Double crop—existing	95,000
Present single crop coming under double crop newly	70,000
Total ..	1,051,000

New Area

	acres.
Single crop	196,000
Double crop	105,000
Total ..	301,000

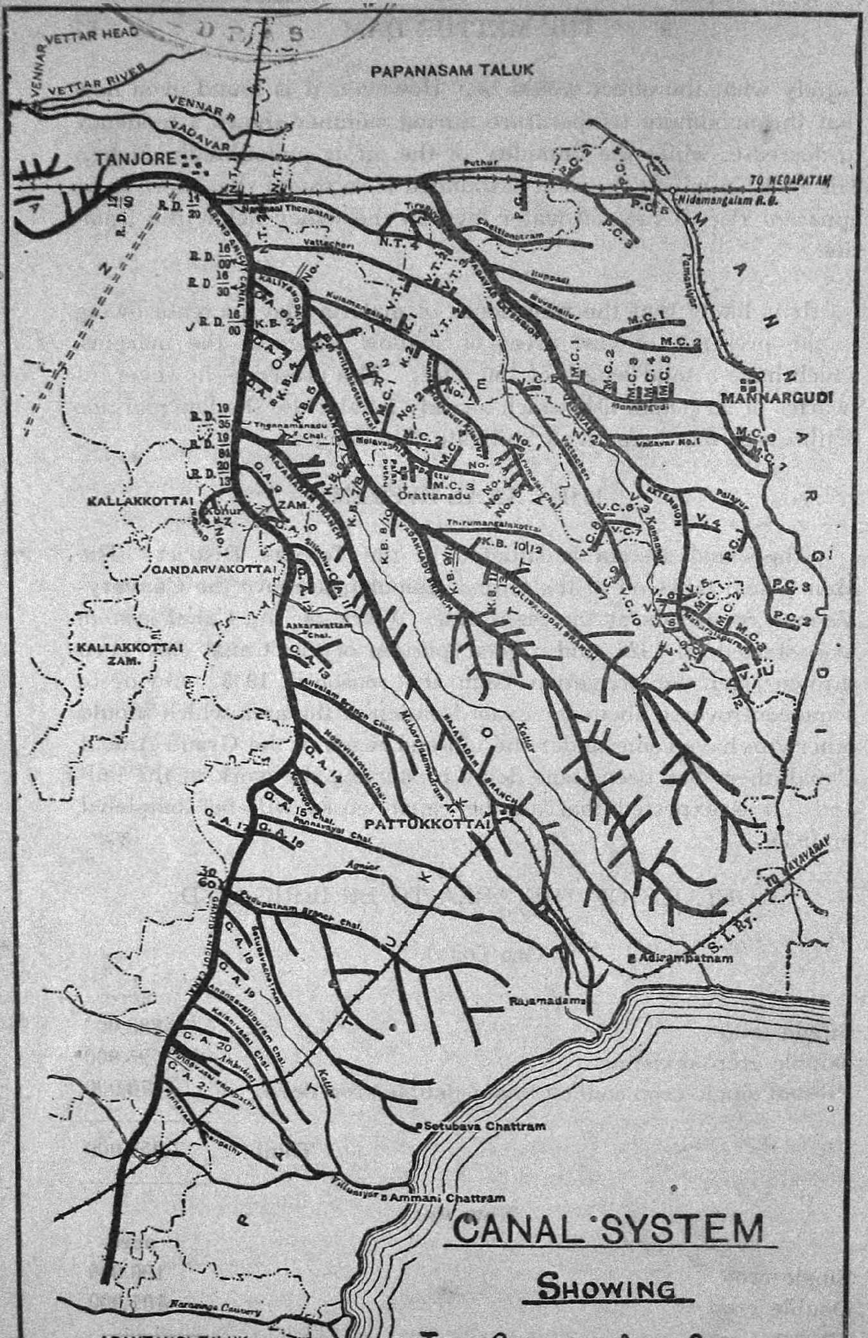

PAPANASAM TALUK
VETTAR HEAD
VETTAR RIVER
VENNAR R
VADAVAR
TANJORE
TO NEGAPATAM
Nidamangalam R.S.
MANNARGUDI
Orattanadu
KALLAKKOTTAI
GANDARVAKOTTAI
KALLAKKOTTAI ZAM.
PATTUKKOTTAI
Adirampatnam
Rajamadam
Setubava Chattram
Ammani Chattram
ARANTANGI TALUK
CANAL SYSTEM
SHOWING
THE CANALS AND CHANNELS

Fig. 5.

Other Details

	miles
Length of main canal	106
Length of branches and distributaries	694
Length of field channels	1,904
Total cost of canal system (estimated)	Rs. 200.0 lakhs.
Cost per acre of new irrigation	Rs. 66-7-0

The indirect benefits which must necessarily accrue from the development and improvement of irrigation in the Trichinopoly and Tanjore districts must inevitably lead to the greater prosperity of the people, better roads, more schools, greater industrial development and increased revenue to Government. The Project has been completed at a time of unprecedented depression in the prices of produce, and the development of irrigation may be somewhat slower than the forecast made when sending up the estimates for sanction. It is hoped, however, that brighter days are ahead and that prosperity will soon return with the rapid development of irrigation which this Great Project has been designed to effect.

HISTORY OF THE SCHEME

The Mettur Dam is believed to be the largest in existence, the net capacity of the storage being 93,000 million cubic feet as against the 43,934 million cubic feet capacity of the Krishnarajasagara and 37,600 million of the Assuan Dam in Egypt.

It was exactly one hundred years ago that Sir Arthur Cotton urged the desirability of constructing a dam across the Cauvery in order to regulate the supply of water to the Cauvery Delta, where the North East Monsoon, by its capricious character, failed to provide the extensive irrigated lands, with the necessary amount of water. As Mr. Stoney, the then Superintending Engineer, explained in his speech in July 1925, when Viscount Goschen laid the foundation stone of the Mettur Dam, the question whether the Dam ought to be constructed across the Cauvery or the Bhavani was canvassed for a series of years, and it was only in 1901 that the former was finally decided upon. Three years later, Mr. Moss prepared the estimates for the construction of a reservoir of 40,000 million cubic feet capacity, three miles from Neringipet, at a cost of Rs. 292 lakhs, for not only the Cauvery Delta, but also for irri-

gating a portion of the Salem and Coimbatore districts. Owing to the disproportionate cost with reference to the small area likely to be irrigated by including Salem and Coimbatore, this scheme was given up in favour of the one prepared in 1910, by Col. Ellis at an estimated cost of Rs. 385 lakhs. In the meanwhile, however, the Mysore and the Madras Governments were in correspondence regarding the sharing of the surplus waters of the Cauvery. The claim put forward by Mysore for raising the height of the Dam at Krishnarajasagara led to a big controversy and after a series of meetings, conferences and arbitrations, the question was finally decided at the time when Sir K. Srinivasa Iyengar was member of the Executive Council, making it possible for the Mettur Dam construction to be commenced.

THE COST

The cost of materials and labour had, in the meanwhile, gone up and fresh estimates for Rs. 612 lakhs were sent up to the Secretary of State in 1924 for sanction, which sanction was received in 1925. The administration Report for 1924-25 thus describes the works as then contemplated:

"The project, as a whole, has been constituted a circle of superintendence with a senior Superintending Engineer in charge for the present. The object of the scheme is to provide a reservoir which will, in the first place, regularise and safeguard the supply of water for an area of over a million acres of irrigated crop in the Cauvery delta (the supply is at present liable to extraordinary fluctuations and to failure at critical seasons) and, in the second place, enable irrigation to be extended to 300,000 acres of land now unirrigated. It involves the construction of a masonry dam (which will be larger than any dam now in existence and will form a reservoir with an effective capacity of 93,500 million cubic ft.) at Mettur above the junction of the Cauvery and Bhavani rivers, and a main irrigational canal about 88 miles in length, with a connected distributory system, having its off-take on the right bank of the Cauvery above the existing Grand Anicut. The new irrigation is expected to add 150,000 tons of rice to the food supply of the country. The estimated cost of the project as a whole is Rupees 612 lakhs and the net revenue with water-rates at Rs. 15 per acre for the first crop and Rs. 7-8 for the second is estimated to be rather over Rs. 46½ lakhs per annum, representing a return of nearly 7½ per cent on the sum at charge. The scheme will be financed

from loans. The programme contemplated in the estimate provides for the completion of all work in ten years and for the realisation of the full revenue by the twelfth year."

Subsequently, however, a new site had to be chosen one mile up-stream owing to the experience gathered from the unprecedented floods of 1924 and, soon after, Mettur was converted into a small town for the benefit of the contractors, coolies and officials engaged in the work, with complete sanitary improvements, lighting and other arrangements.

Visitors to Mettur would have seen the two big concreting towers which are over 300 feet in height. These were used for mixing, lifting and placing in position concrete, the dam having been constructed with cement obtained from Shahabad and concrete.

THE CANAL SYSTEM

A cardinal feature of the Mettur Project is the Canal system, the new Grand Anicut Canal taking off near the Cauvery-Vennar regulators, with branches and distributing channels costing over Rs. 200 lakhs. Since the first concrete foundation stones were laid in 1928, it has taken six years for the completion of the Mettur Dam and the final cost of the whole System is placed at Rs. 680 lakhs, as against the estimated cost of Rs. 737 lakhs. Owing to the economic depression and the unwillingness of ryots along the Canal System to take up water from the project, a good deal of delay has taken place in making the best use of the system; and the authorities are now placing the eventual return on capital at 6 per cent—an anticipation which remains to be proved.

The lake covers an area of 60 square miles and people living in the villages had to be compensated for. The Dam is exactly two feet over a mile. It is estimated that the project will ultimately irrigate nearly 300,000 acres, besides increasing the second crop cultivation to the extent of one half of that area, in addition to regulating the supply of water for the whole Cauvery delta.

Hydro-Electric installation, which is a part of the Project, has been constructed to develop a maximum capacity of 49,000 horse-power. Four sets of Hydro-Electric pipes have been built into the dam and with an average head of 125 feet, the horse-power developed will be 30,000 on the average. There will be four turbines of which one will act as a standby in cases of emergency.

SOME FACTS AND FIGURES

The following comparative figures will be read with much interest :—

206,000 tons of cement and 55,000,000 cubic feet of masonry have been used in the construction. The Dam is so high that the lake entirely fills the valley and when the river is in flood the excess water will spill over the end of the valley through a large surplus escape into the next valley and after cutting a fresh course for itself there, will join its old course 2 miles lower down.

The Dam is the largest single block of masonry in the world. The total length is 5,300 feet and average height 215 feet above the foundations and 176 feet above the river bed. The cubical contents exceed 54½ million cubic feet. It will irrigate about 1,300,000 acres of rice-fields 125 miles away from the Dam and with 70 miles of main canals and 600 miles of distributaries. The Dam is the cheapest per unit of water stored of any of the large Dams. It has also the largest water storage. The tabular statement of the world's largest reservoirs given below will be of interest for comparison.

Name of dam.	Cost.	Masonry contents.	Water Storage Capacity.	Period of construction.
	Lakhs.	million cubic ft.	million cubic ft.	years.
Assuan (Egypt) ..	367	18.8	37,600	4
New Croton (America) ..	212	23.1	5,120	14
Sennar (Africa) ..	847	14.8	22,560	7
Krishnarajasagara (Mysore-India) ..	250	29.9	43,934	16
Nizamsagar (Hyderabad-India) ..	366	30.1	25,446	—
Lloyd Dam (India) ..	172	21.3	24,198	6
Mettur Dam (South India) ..	478	54.6	93,500	6

Extracts from the Hindu.

THE PURPOSE OF THE SCHEME

Glaring Misconceptions Removed.

BY

DEWAN BAHADUR N. SWAMINATHA AIYAR,

Chief Engineer, (Retd.)

An article on the above subject might appear superfluous if not altogether unnecessary in view of the fact that the project has been talked about for years past and is taken to be so very widely known, especially in the Tanjore district. But when I was present at a recent conference of the Tanjore Landholders' Association, which was presided over by Diwan Bahadur M. Ramachandra Rao, several leading Mirasdars made all sorts of statements condemning entirely the Mettur Project, and one of them went to the length of stating that it has so far produced no good and that conditions have become very much worse than before. It was thus made clear that there is a lot of misconception about the project and this is the reason why I have been induced to write this article.

TO IRRIGATE AN AREA OF 301,000 ACRES

Having been connected with the P.W.D. for over thirty years and retired from service only recently, I believe my views are still viewed with a certain amount of suspicion as not appreciating correctly the difficulties of the ryots. I have therefore taken care to see that the facts of the case are stated correctly so as to remove misconceptions and left it to the readers to draw any inference they like. Briefly told, the project aims at stabilising the supplies to the existing delta and irrigating an area of 3,01,000 acres in the new area, commanded by the Grand Anicut Canal and the Vadavar Extension Canal, together with their distribution systems. Dealing first with the conditions in the Old Delta and how they have been affected by the Mettur Project, it would be as well to state that the reservoir provides for (1) An early supply to enable the cultivation of all lands in the delta, especially the double-cropped area. (2) A steady supply thereafter with reference to the requirements of irrigation for standing crops till they are harvested. (3) A mitigation of the floods to such extent as it is afforded by the moderating influence of the Reservoir at Mettur. Regarding item (1), the date of opening of reservoir is notified to be June 15th for double-cropped lands; and July 15th for single-cropped

lands; but these dates would be advanced up to the limit of 15 days *i.e.*, to June 1st and July 1st with reference to supply level in reservoir, taking care to see that there is no interruption in supply after the reservoir is opened for irrigation. Previously, there was no opening date and the supply in river depended on the breaking of the South-West Monsoon and the consequent rains in the catchment of river especially in the upper hilly portions. The supplies thereafter were irregular, if not uncertain, and there was no knowing as to what should be done as regards cultivation until the supply in the river improved and became fairly steady indicating that the monsoon is established. This uncertainty has been removed and a definite date will be available to start agricultural operations.

MIRASDARS' GRIEVANCES

The general complaint at the conference was, that the early supplies are confined to certain rivers and thus ignored altogether the need for early cultivation of lands grown with Ottadai. This is no doubt true to some extent as nothing will be gained by wasting the supplies in those rivers under which no double crop is grown and Ottadai crop was not treated as a double crop requiring early supplies. This does not, however, mean that the early supplies let down in the rivers are just sufficient to irrigate the present double crop area of 75,000 acres. They are much greater being nearly double or treble the quantity required and this extra supply is given firstly with a view to fill up all rivers, channels, and tanks so as to afford drinking supply to all villages and secondly to induce the growing of double crop over a greater area. This early supply is a great advantage for double-cropped lands in that it will enable the crop to be harvested before the North-East Monsoon breaks in and damages it as is often the case now. If Ottadai crop is also found to require early supplies there should be no great difficulty to arrange giving such supplies to them.

Supplies required for the single crop area are proposed to be given from July 15th so as to conform to the present practice and enable the harvesting of crops in February next year after the North-East Monsoon rains are over. If supplies are given very much earlier, the crop which will mature correspondingly earlier might get damaged by rains just before they are harvested. This aspect of the question will have to be carefully examined before any alteration is made in the date fixed for giving supplies to single crop lands.

DEFECTIVE DISTRIBUTION

Another grievance voiced forth by several Mirasdars is that the rivers did not run as full as in a normal flood. Apparently, they imagine that the rivers should run full to overflowing irrespective of the requirements of the irrigation. The quantity allowed to flow down the river is determined with reference to the requirements of the irrigation in the several periods of the irrigation season and aims at maintaining full supply levels in all the rivers taking care to see that there is no inequality in distribution at the several regulators. Under the conditions, prior to the advent of the Mettur Project, the rivers were no doubt occasionally in floods, especially during the months of July and August. A great portion of these floods discharged into the sea unutilised and it is only such wastages that are now impounded in reservoir so as to supplement any defect in river flow during the other months of the irrigation season. This steady supply is a great asset, the advantages of which cannot be exaggerated. This does not, however, mean that there will be no room for any complaint of defective supply in any portion of the delta. If such there be, they are due to *defective distribution* of available supplies, which requires to be investigated and remedied and not to *defective supply* as is very often imagined. A clear distinction should be made between defective distribution and defective supply and no inference adverse to the Project should be drawn in the case of the former. The investigation done in the Remodelling Division for over three years and the sanctioned works which have been or are being carried out, aim at correcting such defective distribution wherever it was known to exist. To give only one instance, the open dam at head of Araslar was discharging 50 per cent more than what it ought to carry for the ayacut under it. There were no means of regulating the supply and on occasions when there was excess flow down it, with a corresponding shortage in the other branch, *i.e.*, Cauvery, there was no remedy. With the conversion of the dam into Regulators, which has been completed this year, means have been provided for correcting the inequality in distribution and as a result thereof, the difficulty experienced hitherto will not recur. Other such instances wherever known to exist, have been and are being remedied and if more instances come to notice, they will have to be investigated and remedied in due course.

ERRONEOUS IMPRESSIONS

There is an impression that the authorities are mindful only about the supply to the new canals and channels without caring as to what happens to the existing deltas. This is quite erroneous. The supply levels in the old delta are maintained as usual and then only supply is led down into the new canals. There is absolutely no necessity to cut short the supply to the Old Delta for the sake of the new area. At any rate, such a contingency will not arise now, the area irrigated in the new portion being only about a tenth of the area for which irrigation has been provided for. The supply led down the new canals and branches remain for the most part unutilised. This is why they appear full; but the quantity of water consumed is small being proportionate to the area brought under cultivation.

The absence of any supply in the rivers of the Old Delta during this year's closure was complained of bitterly and was attributed to the Mettur Project. It is clear that this is far from truth. Owing to special works in progress at the Grand Anicut and Cauvery and Vennar Regulators, the hot weather flow was diverted into Coleroon keeping Cauvery and Vennar completely closed. This is a special feature of this year which will not ordinarily occur. At any rate, the Mettur Project has nothing to do with it.

Another subject which was persistently talked about is the question of silt entrapped in the Reservoir. It cannot be denied that a portion of the silt brought down by the river Cauvery at Mettur is entrapped therein; but when the discharge required for irrigation or the floods are passed down through the supply or overflow sluices as the case may be, most of the silt, especially of the lighter type passes down and it is only the heavier sandy silt which will settle down in the Resesvoir. Again the silt brought down by Bhavani, Amaravathi and Noyyal which is considerable passes down into the delta as hithertofore. The grievance is therefore true only to a very small extent and is very much exaggerated even long before they have been able to realise what it will be in practice.

There is again a strong feeling against the localisation of double crop lands. This proposal has been started mainly with the idea of ascertaining how the area is distributed at present and what steps should be taken towards increasing that area so as to form compact blocks which would result in economy of supply and

efficiency in distribution. Already the double-cropped area is confined mostly to Tanjore, Papanasam, Kumbakonam and portions of Mayavaram and Mannargudi Taluks. A line drawn right across the delta from north to south along the eastern boundary of Kumbakonam Taluk will form roughly the demarcating limit. It will therefore be a business proposition to confine the supply to this portion, taking care however to see that all rivers, channels and tanks are given the first flushing to provide drinking water-supply to all villages and to enable seedlings to be grown for such stray areas, as have been cultivated hitherto with double crop. The question will require to be thoroughly examined after proposals are framed by Government and it is therefore premature to condemn the proposal outright at this stage.

POTENTIALITIES OF THE METTUR AREA

POSSIBILITIES FOR NEW INDUSTRIES

The industrial possibilities and potentialities of the Mettur Project are referred to at some length in an illustrated pamphlet prepared by Mr. L. B. Green, M.B.E., Deputy Director of Industries. It is an interesting document well worth a perusal by the public interested in industrial development.

The headworks area of the Project includes Mettur township on the right bank of the river Cauvery, in the Mettur taluk of the Salem District, with an extension on the left bank. The two parts are connected by a girder bridge of sixteen spans across the Cauvery, carrying two lines of tram rail and a road. The site is connected with Salem Junction on the main line of the South Indian Railway (broad gauge) by a branch line 26 miles long, and with Erode, another junction on the main line, by a motor road 35 miles long. This branch line, we are told, forms part of a projected railway from Trichinopoly via Namakkal-Salem-Dharmapuri-Hosur to Bangalore. Mr. Green says when this through communication is established, it will tap the Bangalore area and be the shortest route for bringing cotton, etc., from Bellary to Mettur. The township, as will be seen from a perusal of this pamphlet, possesses the most up-to-date amenities; it is carefully laid out, and traversed by metalled roads, and will shortly be connected by a metalled road with the Madras—Calicut trunk road,

The object of the publication is to invite the attention of manufacturers in India and abroad to the facilities which will be afforded by Mettur, on the completion of the Project in 1934, as a suitable location for the establishment of manufacturing industries and the setting up of mills and factories of various kinds.

The pamphlet then describes in brief the works proper, the history of their inception, the geographical situation of the Mettur Settlement and facilities for communication by rail and road, the existing buildings and other amenities, climatic conditions, possibilities of securing cheap labour, water-supply, and cost of electric power. We take the following paragraphs from the pamphlet :—

TEXTILE PRODUCTS

Cottage Industries

One of the main difficulties which has tended to restrict the development of industries in South India has been the high price and scarcity of fuel, but the position in this respect will be altered greatly for the better in the areas affected when electric power is available from the Mettur and Pykara projects. When cheap electricity becomes available, it should be possible to greatly develop, in what are to-day purely rural areas, small scale industries for working up into manufactured or semi-manufactured form the agricultural products of the province and thus to improve the economic condition of the villages with a consequent increase in the amenities of life on the countryside. Electricity, where available at a reasonable price, will provide greatly improved facilities for the development of rural tracts. Electric power can be used for such varied purposes as pumping, sawing, fodder cutting and grinding, rice hulling, groundnut decorticating, oil milling, cotton ginning, bone-crushing, sugarcane crushing and sugar manufacture.

The development of textile industries in the home will also be fostered by a cheap electric supply and the following home industries of this character may be mentioned :—

(1) Single power loom for cotton weaving.

(2) Single power loom for silk weaving.

(3) Single power knitting machine for making socks.

(4) Single power circular knitting machine for making banians with artificial silk.

(5) Single power Barfus loom for mesh banians,

(6) Power warp preparation factory for supply of warp to knitting machines.

(7) Power warp preparation for supply of warp to cottage cotton power looms.

(8) Power warp preparation for supply of warp to cottage silk power looms.

(9) Dyeing and stencil printing.

Again, the facilities that will be afforded in the Mettur area, when the project is completed and cheap electricity is available, would appear to offer scope for the setting up of small textile factories of the following descriptions:—

(1) Cotton power looms of 20 looms unit.

(2) Silk power looms of 20 looms unit.

(3) Small factory for the preparation of tapes, ribbons, shoe-laces, saree borders and similar articles.

(4) Warp preparation factory for supply of warp to small scale cotton factories.

(5) Silk throwing plant for supply of yarn to small scale silk factories.

(6) Wool spinning plant.

(7) Knitting factories for socks, banians, fish nets, and mosquito curtain cloths.

(8) Dyeing factory.

(9) Central carding factory for distributing silvers to cotton spinners.

(10) Factory for the manufacture of knitting healds.

(11) Factory for the manufacture of reeds.

(12) Factory for the manufacture of appliances such as jacquards, dobbies and slays, jacquard cards, shuttles, pirns, bobbins, etc.

TEXTILE MILLS.—COTTON SPINNING AND WEAVING MILLS

In view of the fact that a considerable proportion of the raw-cotton produced in the Madras Presidency is exported, there is considerable scope for the establishment of additional power spinning and weaving mills. In the Madras Presidency, the cultivation

of cotton is largely carried on in the districts of Tinnevelly, Ramnad, Madura, Coimbatore, Trichinopoly, Salem, Cuddapah, Anantapur, Bellary, Nellore, Kurnool, Guntur, Kistna, Godavari, and Vizagapatam. Mettur is situated in the Salem district and is bordered by the Coimbatore district. The trade names of the several varieties of cotton grown in the Madras Presidency are 'Cambodias', 'Tinnevellies,' 'Salems,' 'Northerns and Westerns', and 'Cocanadas.' 'Cambodias' are grown in the districts of Trichinopoly and portions of Coimbatore and Madura district, 'Tinnevellies' in the districts of Tinnevelly, Ramnad, and portions of Madura; 'Salems', (Uppam) in the Salem district and portions of Coimbatore district 'Northerns and Westerns' in the districts of Kistna and Guntur, Cuddapah and Chittoor and 'Cocanada' in the districts of Bellary, Kurnool, Anantapur, Cuddapah and Chittoor and 'Cocanadas' in the district of Kistna and Guntur. Of the Southern India cottons, 'Tinnevellies' are well suited for the production of 40s. counts and below, whilst others are suitable for 24s. counts and below. The Northern staple is ⅞ inches, the Eastern ¾ inches, the Cocanada ⅝ inches to ⅞ inches, the Karunganni ⅞ inches the Tinnevelly ¾ inches to ⅞ inches, and the Salem ¾ inches.

The acreages under each variety and the production in bales are shown in the following table :—

1930-31

Trade name.	Area in acres.	Yield in bales of 400 lbs. each.
Cambodias	243,600	87,690
Tinevellies	524,800	128,550
Salems (Uppam)	159,400	33,810
Nadam and Bourbon	41,300	1,790
Northerns and Westerns	920,950	101,460
Cocanadas	163,500	25,290
Others	17,800	2,300

There are about 2,500,000 acres of land normally under cotton cultivation in the Madras Presidency, and the normal annual yield is about 500,000 bales of 400 lbs. each.

SCOPE FOR MORE MILLS

The average annual imports of Madras during the last few years have been 7 million lb. of yarn and 70 million yards of cotton piecegoods, and there can be no question that having regard to the quantity of cotton available in the Province and the market for yarn and piece-goods in it, there is considerable scope for the setting up of additional spinning and weaving mills. There are at present only six or seven weaving mills in the Presidency employing a total of nearly 5,000 looms. The number of spinning mills is 22 and new mills are under construction or projected. The spinning mills employ at present over seven and a half lakhs of spindles.

It will now be convenient to consider under various heads whether the conditions precedent to the establishment and profitable operation of cotton mills exist in the Mettur area. The essential conditions which a site for a cotton mill should satisfy are—

(a) Proximity to cotton-producing tracts.
(b) Availability of power at a reasonable rate.
(c) Transport facilities.
(d) Ample supply of labour.
(e) Sufficient water.
(f) Sufficient humid climate.
(g) Proximity to markets for the disposal of products.
(h) Suitable areas of land for the erection of factory buildings.

(a) Proximity to cotton-producing tracts.—Mettur is in the Salem district. As already stated, cotton suitable for 24s. and below is grown in the district of Salem and in the adjacent district of Coimbatore, while Mettur is in railway communication with other important cotton growing districts, such as Trichinopoly, Madura, Ramnad and Tinnevelly as well as with other districts further afield.

(b) Availability of power at a reasonable rate.—It has been shown that the cost of power at Mettur will probably range from 4 to 6 annas per unit and that an ample supply of water will be available for all purposes.

(c) Transport facilities.—These, which have been described in the Introduction, page 6, as well as on page 13, appear to be favourable.

(d) Ample supply of labour.—There will be a large organized labour force in existence at Mettur on the completion of the project which, after training, would no doubt be suitable for employment in mills and factories. The nucleus of the trained labour for textile mills could be drawn from Coimbatore and other cotton mill centres.

(e) Sufficient water.—Water for industrial purposes could be obtained in almost any quantity from the river Cauvery. It cannot definitely be stated at what price such water will be available, but it could probably be supplied at about Rs. 3 per 1,000 cubic yards, a proportionate rebate being allowed for water returned to the river properly purified to the satisfaction of the health authorities.

(f) The climatic conditions of Mettur have been fully discussed and in Appendix B will be found an extract from the weather reports of the rainfall and evaporation station at Mettur. If necessary, mechanical humidifiers could be installed, although as pointed out elsewhere, the waterspread which will be formed on the completion of the project will almost certainly render the climate more humid and thus more suitable for textile factories.

(g) The distances from Mettur to Salem, Erode, Coimbatore and Madras are 26, 35, 81 and 233 miles respectively. The cloth produced by weaving mills in Mettur should be able to find a sale in Madras and other important consuming centres. If cheap yarn is produced by spinning mills set up at Mettur, it should be readily absorbed by the handloom weavers in the various districts of the Presidency with which Mettur is in road and rail communication.

(h) On the Salem side of the river suitable factory sites are available near the railway station and could be purchased from Government or from private owners.

The chief items in the manufacturing costs of a cotton mill excluding raw materials, are labour and power. It is generally recognized that in order to obtain the best results and maximum production from spinning and weaving machinery, it is necessary to apply an even turning moment at the driving shaft of the machine free from cyclical irregularities and to maintain a close speed regu-

lation. In a mill supplied with power produced by a reciprocating engine, cyclical irregularities in the speed of productive machinery must occur. A rapid increase in the use of electric power in the textile industries is taking place in all countries and the majority of the machinery now turned out is made for motor drive. With electric drive increased productive efficiency as also a better product—whether it be yarn or cloth—could be obtained. Mettur would therefore appear to offer special facilities for the setting up of cotton mills by reason of its cheap power and other advantages.

DYEING FACTORIES

Dyeing factory.—If spinning mills are set up in the Mettur area for the production of yarn, and weaving mills for the production of cloth, there should be scope for the establishment of bleaching, dyeing and finishing plants as adjuncts to such mills. The essential requisites for a dyeing factory are—

(a) Cheap power.
(b) Adequate supply of suitable water,
(c) Skilled labour, and
(d) Availability of yarn and cloth for dyeing.

Factors (a) and (b) will be present at Mettur, the permanent hardness being only two parts per 100,000. The requisite skilled labour could be attracted to the spot while, if spinning and weaving mills are set up, supplies of yarn and cloth for dyeing will be available.

It is estimated that a small factory at Mettur turning out 12,500 lb. of dyed yarn per month should be able to produce dyed yarn at 8 annas per lb. There would seem to be scope for a small dyeing and aerograph printing concern.

CHANCE FOR SILK FACTORIES

Silk industry.—The manufacture of silk goods is by no means an unimportant section of the handloom weaving industry, while silk enters into combination with cotton in a number of varieties of cloth. India produces from one and a half to two million pounds of raw silk annually and also imports from China and other countries about an equal quantity. The magnitude of the industry may be gauged from the fact that in the Kollegal taluk of the Coimbatore district 25 lakhs of rupees' worth of raw silk is manufactured

annually. In addition to this quantity, about a crore of rupees' worth of raw silk is imported into the Madras Presidency from other parts of India and from foreign countries and the whole of this quantity in addition to the silk produced in Kollegal is used by the weavers. Raw silk is at the very outset a fine yarn, but it requires doubling and twisting so as to produce a thread sufficiently thick to stand the strain involved in the process of weaving. If therefore twisted silk is produced at Mettur with the aid of the facilities available there, it should find a ready sale amongst the handloom weavers of the Presidency. In fact, the establishment of silk throwing factories is essential for the development of power loom silk weaving on a small or large scale in this Presidency.

HOSIERY MANUFACTURE

Hosiery industry.—If spinning and dyeing concerns are started in the area, Mettur with its cheap electric power would seem to afford scope for the establishment of well-conducted power-driven hosiery factories, as the necessary supplies of yarn could be obtained from the spinning and dyeing mills. The market for hosiery goods in India is a growing one, only the fringe of the potential demand having yet been touched. India is Japan's principal customer, importing knitted goods from that country to the extent of over 3,300,000 dozen in 1929.

IRON ORES OF SALEM

The iron ores of Salem, admitted to be of a very high grade quality and the magnesite ore, said to be the finest in the world, open up possibilities of a profitable investment to enterprising capitalists with the facilities now afforded by the Mettur Project. The pamphlet of the Deputy Director of Industries discusses this question at some length.

The development of electric power on a large scale at Mettur and the consequent availability of a cheap supply a few years hence opens up the question of the exploitation of the Salem iron ores with power derived from the Mettur Project. The history of the attempts to manufacture iron by European processes in the Madras Presidency dates back to the early part of the last century. The presence of rich iron ores in the southern taluks of the Salem district and the existence of an ancient indigenous iron smelting indus-

try in numerous centres of this area, an industry which though working with exceedingly crude appliances produced excellent wrought iron and steel, attracted attention so far back as 1818 when Mr. J. M. Heath of the Madras Civil Service conceived the idea that a profitable business could be established by the application of modern methods and machinery to the industry. After resigning the service, he obtained in 1830 from the East India Company, exclusive rights for carrying on operations throughout the Madras Presidency. Blast furnaces were erected at Porto Novo on the East Coast and though it was proved that excellent pig iron could be made from the Salem ores, commercial success was not achieved. A new Company styled the 'Porto Novo Steel and Iron Company' took over the furnaces and enlarged them, built others at Beypore on the West Coast and carried them on till 1849 but still unsuccessfully. Another Company styled 'The East India Iron Company' acquired the concern in 1853 and built furnaces at Tiruvannamalai and another at Pullampatti on the banks of the Cauvery in the Salem district. They made roads from Pullampatti to Kanjamalai which contains the most celebrated of the magnetic iron beds, carried the ore to the works on the river and smelted it there with charcoal brought by boats from Sholapadi, 18 miles up the Cauvery. The Company commanded large capital and established foundries, puddling forges, rolling mills and even Bessemer steel converters. It was not commercially successful and the operations came to an end in 1867. Yet another attempt was made in 1875 by the Napier Foundry Company of Madras to establish an iron industry on a large scale, but with its failure in 1877 ended the last attempt to manufacture iron by European processes in the Madras Presidency. In 1895, the question of working the Salem iron ores again received attention. The construction of the railways which connected the Salem district with the East and West Coast and with the Singareni coal fields, the cheapening of ocean transit and the improvements by inventors generally in iron and steel making plant and in furnaces effecting considerable reduction in the cost of production introduced new factors in the situation. The Secretary of State submitted the question for the consideration of Mr. Jeremiah Head, a past President of the Institute of Mechanical Engineers, who went into the whole question very carefully. Mr. Head's conclusions which were arrived at after a study of the whole question were briefly: (1) that an export trade in Salem magnetite to European ports must 'for the present' be given up as impracticable as it could not be delivered at prices prevalent there except at a loss; (2) that charcoal

pig iron could not be produced in the Salem district at a cost which would enable it to compete either there or at Madras with imported pig iron and (3) that the substitution of Singareni coal would not improve the chances of success. The question was revived in 1914 by Messrs. E. Gaudart and Company of Pondicherry. They obtained a mining lease for over 4,369 acres in the Kanjamalai reserve forest for the purpose of working the iron ore. They extracted a small quantity of the ore and sent ten tons to France for a magnetic concentration test. The report was favourable, but the War prevented the working of the concession, and the lease was cancelled towards the end of 1916.

HIGH QUALITY OF THE ORE

The electric iron smelting industry is well established in Sweden, such electric furnaces having been set up to replace the small charcoal blast furnaces in which high grade Swedish iron was formerly made. The substitution of the electric furnace in place of the charcoal blast furnace in Sweden was due to the necessity of cheapening the cost of production of pig iron since the cost of making the iron using cheap Swedish water power is less than in the blast furnaces. Swedish experience goes to show how vital the question of the quality of the ore becomes when it is dealt with in furnaces of small dimensions and yield. So far as the Salem ore is concerned, it has enjoyed a traditional reputation for high quality and has been held to be equal to the Scandinavian ore. The statements in the District Gazetteer that it is possible to obtain in Salem an almost inexhaustible supply of ores with an average of nearly 60 per cent of iron and that the ore contains no phosphorus or sulphur (which detract from its value for purposes where a high grade iron is required) represent the strength and vitality of this tradition. In 1914, when Messrs. Gaudart and Company of Pondicherry submitted the question of the quality of the ore to the Geological Survey, the opinion was expressed that the ore with an iron percentage of 50 to 60 occurred only in 'small pockets' or as veins, and referring to a previous analysis of a specimen which showed a percentage of 39.02 of iron, it was thought that this represented the real crude ore of Kanjamalai, which anyone working the deposits on a large scale would have to deal with. Subsequently, in order to settle the question of the quality of the ore, a number of samples of iron ore from the Salem district which previously had been collected by Sir Thomas Holland were analysed by the Geological Survey of India. Of the six analyses that were made, two showed iron percentages between 67 and 69 while in the other four the iron was

as low as 30 to 40. In 1925 three tons of Kanjamalai ore was, at the instance of M. Gaudart, subjected to extensive concentration trials by Messrs. Fried Krupp, and the results, which were distinctly promising, went to show that the ore could be improved by magnetic concentration as readily as similar Swedish and Norwegian ores. A sample of the powdered and concentrated ore was therefore submitted to the Geological Survey of India for opinion and when assayed gave 66·9% of metallic iron. The Director of Geological Survey reported that the material was highly magnetic and evidently consisted of magnetite and that there was a concentration of 92.4 per cent Fe_3O_4. It was pointed out by the Director that any ore containing over 60 per cent of iron may be looked upon as first-grade ore, and that there is no question therefore of the grade of the Kanjamalai concentrates. The conclusion that emerges from study of the documents bearing on the question of the development of the Salem iron ores is that the obstacle in the way of the success of these ventures was the difficulty of obtaining a continuous and sufficient supply of cheap fuel. In Mr. Head's report it is stated that the lack of cheap fuel is the main difficulty, while M. Gaudart has expressed a similar opinion. The availability of cheap power from Mettur which is only about 40 miles from Kanjamalai would therefore appear to justify a re-examination of the question and it would probably be well worth while for a prospective manufacturer to verify the existing data by arranging for a magnetic test to be carried out on a bulk sample of the ore.

SALEM MAGNESITE

There are very extensive deposits of some of the finest magnesite in the world in the Salem district, but although this mineral is usually considered to be of considerable value, the deposits do not appear to be worked to an extent at all comparable with their magnitude. This is due to a variety of causes, the chief of which appears to be the restricted demand both in the country itself and for export purposes. Though almost unlimited quantities of crude magnesite are available, it has not been possible so far to increase the demand for the material. The increase in the United States import duty on calcined magnesite in 1927 from 14 to 21 dollars per ton has had an adverse effect on the Salem magnesite industry, there having been a reduction in the tonnage exported to that country, while the profit on the reduced shipments is said also to have declined. Unless therefore new outlets can be found for the mineral, the outlook for the industry in the Salem district does not ap-

pear to be particularly promising, although the demand in the country itself for magnesite in the form of floorings is expanding to a limited extent. Salem calcined magnesite is considered to be about the best in the world for magnesite composite floorings and other similar uses in the building industry. Deadburnt magnesite, as used in steel furnaces and the manufacture of bricks therefore is in large demand, and there would seem to be possibilities in regard to the manufacture of this form of magnesite at Salem although a difficulty is that Salem magnesite is very pure and contains very little iron. Cupels for gold and silver assays are also manufactured in the Salem district from the material.

A possible use of magnesite is in the production of magnesium sulphate or epsom salt by treating the magnesite with sulphuric acid. Although magnesite is so cheap, the price of sulphuric acid is high and it is probable that a factory established at Mettur on a large scale could operate with a margin of profit only if a good price could be realised for the carbon dioxide recovered in the process.

A new process is believed to have been evolved recently for the manufacture of magnesium metal from magnesite, and to this is due the increased demand for crude magnesite. Magnesium metal is lighter than aluminium and the demand for it is expected to be great. If the commercial possibilities of magnesium metal are established, it would seem well worth while for manufacturers to consider the setting up of a factory in the Salem district for the manufacture of the new metal with the aid of the cheap electric power available from the Mettur Hydro-Electric Project. It is understood that a market is already developing in fused pure magnesite, and it should be practicable to fuse such magnesite with cheap electrical power at Salem as is done in Switzerland.

MANUFACTURE OF CHEMICALS

SCOPE FOR FERTILISERS

The prospects of Madras becoming a centre for the manufacture of chemicals are surveyed by Mr. Green in his pamphlet on the industrial possibilities of the Mettur area.

The suitability of Madras as a centre for the manufacture of certain basic chemicals has been investigated from time to time, but

the conclusion arrived at was that the prospect of the development of a heavy chemical industry in Madras was remote owing to the high cost of fuel. In any attempts to foster the development of chemical industries in India, attention should be directed in the first instance to such industries as can utilize Indian raw materials now exported to foreign countries where they are worked up into various finished products. Under this category may be included the raw materials from which vegetable oils, artificial fats and feeding cakes are manufactured. The fact that during the next few years cheap electric power will be available in the Mettur area seems to justify a re-examination of the possibilities of establishing certain chemical industries in this Presidency. Second only to sulphuric acid in importance for the development of chemical industries are the alkalies (sodium carbonate and sodium hydroxide), since little expansion of other industries can take place unless these chemicals are available at a low price. The question whether there is scope for the development of the alkali industry at Mettur would seem to merit examination. The bulk of the caustic soda now manufactured in America and Europe is produced electrolytically from aqueous solutions of common salt. The power for generating electricity is usually and most cheaply provided by water power and so the Niagara Falls in America and the waterfalls in Norway and other countries rich in water power are the main seats of this industry.

THE ALKALI INDUSTRY

Electrolysis of salt solution.—The products obtained from the electrolysis of an aqueous solution of common salt are caustic soda solution, chlorine and hyrogen.

Caustic soda.—The caustic soda solution can be evaporated and caustic soda prepared. It finds a use in many industries including soap, textiles (mercerising of cotton), paper, dyeing and purification of petroleum and mineral oils. The caustic soda could also be converted into sodium carbonate or sodium bi-carbonate. The imports of sodium bi-carbonate into India are about 110,000 cwt.

Chlorine.—The annual yield ot chlorine from the electrolysis of common salt solution would be about 400,000 cwt. Chlorine is not imported into India to any appreciable extent. It can, however, be used for preparing bleaching powder, the other chemical required being lime which is available in the vicinity of Mettur. Bleaching powder is used for bleaching textiles and paper pulp; whilst large

quantities are also required for the sterilization of water and for the preparation of hospital disinfectants.

Hydrogen.—The annual production of hydrogen would be about 120,000 cwt. and a portion of this quantity could be used for the hydrogenation of oils. The balance of the hydrogen could be converted into hydrochloric acid.

Fixation of nitrogen.—In this process the nitrogen of the atmosphere is made to combine with elements under definite conditions of temperature and pressure resulting in the production of compounds such as cyanamide, ammonia and nitric acid.

PULP AND PAPER PRODUCTION

POSSIBILITIES IN METTUR AREA

That the facilities for securing the essentials of production like continuous and cheap supply of raw materials, motive power and water supply have now become adequate to establish pulp and paper manufacturing industries in the Mettur area is the view held by Mr. Green, in his interesting survey of the possibilities of opening up the Mettur area.

Mettur would appear to offer considerable scope for the establishment of a pulp or paper industry. In view of the heavy capital requirements of the industry, the first essential is a continuous and assured supply of the raw material. Investigations recently undertaken by the Forest Department indicate that a secure supply of bamboos existed and that the fundamental problem of getting the supply to a mill at Mettur would not present insuperable difficulty. The raw material occurs within forty miles of Mettur and bamboos in exploitable quantities are found over an aggregate of 35,000 acres in the reserves of Ramapuram Forest range, whilst an additional area of 5,000 acres carries bamboos in the unreserves. If a reasonable reduction is made in the gross bamboo area, it may safely be estimated that 25,000 acres contain dense bamboos. The Ramapuram bamboos are not, however, the only possible source of raw material for a pulp or paper mill at Mettur. There are extensive bamboo areas in Bargur range which are within easy access of the Palar and the Cauvery, and bamboos from this range could be float-

ed down to Mettur. On the Palamalai hill, which adjoins Mettur, 3,000 acres contain bamboos. The average lead from this area to Mettur is under ten miles. There are in addition vast bamboo tracts in Bargur and Bhavani ranges, the outturn from which could be carted down to Mettur. It is probable that similar bamboo areas exist on the Salem side of the Cauvery. According to Mr. Raitt, the authority on the utilisation of bamboo for pulp and paper manufacture, a plant producing 10,000 tons of pulp is the smallest that would be economically feasible. Thus a sustained annual supply of 22,500 tons of air dry bamboos is the minimum required to run a pulp mill at a profit. If, however, a paper mill instead of a pulp mill were established at Mettur, a smaller unit producing about 5,000 tons of paper would be an economic proposition and in this case the minimum raw material required would be only 11,660 tons. The Forest Department estimates that from the Ramapuram range alone, an annual outturn of 28,000 tons of air dry bamboo could be obtained which in itself should be sufficient to support a 10,000 ton pulp plant. It will be evident, therefore, that a pulp or paper mill at Mettur would be extremely unlikely to fail for want of raw material.

TRANSPORT CONDITIONS

Transport conditions.—The bamboo tracts in Ramapuram range are disposed round a central point called Uthupium within a radius of six miles. This point lies at an elevation of 1,500 feet and would form a convenient base for the bamboo exploitation operations as the river Cauvery flows within ten miles of Uthupium. The road which would have to be constructed in order to transport bamboos to the river would pass through easy country and the cost of construction is not likely to exceed Rs. 2,500. An alternative course would be to construct a tramway between Uthupium and the rafting station. From the rafting station the bamboos would be rafted down the Cauvery to the mill at Mettur over a distance of a little more than twenty miles. It is possible that artificial propulsion of the rafts might be necessary on account of the absence of a current strong enough to move the rafts quickly above the dam. The scheme of extraction would therefore be as folows: Bamboos would be cut by coolies and dragged or carried by them to the collection depot at Uthupium. From Uthupium they would be transported in carts or trains running on a tramway down to the Cauvery, whence they would be rafted to Mettur.

Cost of extraction of bamboos.—The cost of a ton of air dry bamboo at works is estimated as follows: —

Item.	Rs.	A.	P.
1. Cost of felling 450 bamboos and transporting to collection depot for an average distance of 4 miles.	6	0	0
2. Cost of transport of carts for a distance of 10 miles from collection depot to rafting station (one cart will carry a ton) ..	2	8	0
3. Transport by rafts to works a distance of a little over 20 miles say ..	2	0	0
4. Contingencies ..	0	4	0
..	10	12	0

Thus the total cost of one ton of air dry bamboo at works amounts to Rs. 10-12-0. Allowing a margin of 25 per cent, the equivalent of a ton of paper pulp will cost about Rs. 30-4-0. To this must be added the royalty payable to Government, say Re. 1 per ton of bamboo. Government would probably be willing to lease the bamboo area for a term of say 20 years.

Labour.—Labour is available in the local villages, though it is not perhaps likely to be sufficient for the bamboo extraction operations and it may be necessary to import additional labour. There should be no serious difficulty in regard to this, however, as the completion of the Mettur Project will throw large numbers of men out of employment and they will be available for the mill as well as for the collection of raw material. Coolies can always be obtained from the Salem side of the Cauvery.

Index Figure of Prime Costs.—As a ready means of ascertaining whether a project is a sound financial proposition or not, Mr. Raitt, the authority previously quoted, has prepared the following index figure consolidating the various items of cost for preparing a ton of pulp: —

	Rs.	A.	P.
1. Two and a half tons of bamboo at Rs. 15 per ton ..	37	8	0
2. Four tons of fuel at Rs. 6 per ton ..	24	0	0
3. Three-fourth ton of limestone at Rs. 8 per ton ..	6	0	0
4. One ton pulp freight to port ..	12	8	0

A mill at Mettur would have an advantage in respect of the price of the bamboo, whilst under fuel there should also be a saving as compared with Mr. Raitt's figures provided the electricity which will be available at Mettur is used for steam raising in the digesters as well as for power. Burnt limestone can be delivered at Mettur for about Rs. 28 per 100 cubic feet. The freight on a ton of pulp from Mettur to Madras would be Rs. 16-7-0.

SPECIAL ADVANTAGES

Advantages afforded by Mettur for the pulp or paper industry. —The general factors favourable to the location of a pulp or paper mill at Mettur may be briefly summarized as follows :—

(i) The species of bamboo occurring in the area is almost exclusively *Dendrocalamus strictus* which is specially suitable as a raw material for pulp manufacture. The Forest Research Institute has demonstrated the suitability of bamboos generally as raw material for paper pulp and in particular of *Dendrocalamus strictus*, the local species of bamboos which is usually not subject to gregarious flowering.

(ii) From the Ramapuram Forest range alone it is estimated that at least 25,000 tons of dry bamboo annually could be extracted and delivered at mill site at Mettur for less than Rs. 15 a ton. An adequate and sustained supply of raw material at reasonable rates should therefore be assured.

(iii) River transport would be available for the greater part of the total lead right up to the mill.

(iv) As the proposed mill would be situated on the banks of the Cauvery, an inexhaustible supply of fresh water, an essential requirement of a paper or pulp mill, would be available.

(v) Cheap electric power is available. The cost of power at Mettur would range from 0.4 to 0.6 anna per K. W. H. whilst special rates will be allowed for industrial establishments guaranteeing an annual consumption of not less than 400,000 units.

(vi) Large quantities of limestone of the crystalline variety are available near (1) Mavelipalayam near Sankeri, 53 miles from Mettur ; (2) Pakkanad, a village in Salem district, 15 miles from Mettur by road ; and (3) Anandampalayam, a village 15 miles from Mettur on the road to Bhavani.

(vii) As explained elsewhere, suitable plots of land for the erection of the main mill buildings are available at Mettur, whilst a large number of buildings suitable both for factory and residential accommodation will be available when the Mettur Project is completed.

(viii) As Mettur is on a broad gauge railway line, the import of chemicals etc., and the export of the finished product should present no difficulty.

(ix) Tram lines, haulage engines and other industrial plant could probably be purchased cheaply from the Public Works Department on completion of the dam.

CHANCES FOR PAPER MILLS

Relative advantage of pulp and paper manufacture.—Whether it would be possible to supply the existing manufacturing concerns in India with pulp from Mettur, or whether it would be practicable to export pulp to Japan and Australia in replacement of the considerable quantities which those countries import in normal times from Scandinavia is a matter for expert investigation. Similarly the question of the relative advantages of manufacturing pulp or paper at Mettur is one for decision by experts. The bulk of the trade is conducted in unbleached pulp, but in view of the fact that cheap power will be avilable at Mettur, it might be more advantageous to manufacture the bleached product. Should an alkali industry be started and bleaching powder produced at Mettur a bleached pulp or paper mill would of course be in a particularly advantageous position. Imported bleaching powder could, however, be delivered at Mettur at about Rs. 182 per ton. One of the advantages of manufacturing paper in preference to pulp is that the overhead and depreciation charges to be carried per ton of product can more easily be carried on the higher value of paper than on the lower value of pulp, and further it is perhaps easier to sell paper than pulp. If a paper mill were set up at Mettur, it should be possible to turn out (i) cream laid and other writing paper, (ii) white printings other than newsprint, (iii) wrapping and packing paper, (iv) badami paper, and (v) brown paper of a satisfactory standard of quality. The imports of these and other varieties of paper (excluding newsprint) into the Madras Presidency by sea during the last three years appear to have averaged about 7,200 tons. The market for paper in this Presidency is not at present large, but though the average consumption of paper per head of the population is very low, there can be little doubt that the consumption will develop gradually in response to the growth of education.

The prospects of a pulp or paper mill at Mettur, utilizing mainly the bamboos of Ramapuram range in Kollegal Forest division as raw material, would seem to be reasonably promising. There is, as already shown, ample bamboo within economic reach of Mettur, whilst many other essential conditions appear to be favourable.

EXPLOITATION OF OIL SEEDS RESOURCES

The exploitation of the vast oil seed resources of the Presidency, held up so far by the lack of proper facilities for production and marketing, has now been rendered a commercial proposition through the facilities in the Mettur area and due largely to the demand for vegetable oil and fats for industries like soap, artificial ghee, lubricants, etc. Mr. Green, in his pamphlet on industrial possibilities in the Mettur area, details the prospects of starting hydrogenation factories which might eventually supply not only all our needs but also secure a good export trade in those commodities.

Oil seeds are of great economic importance to the Madras Presidency owing to the variety of the seeds and the extent of their production. Only a very small percentage, however, of the annual outturn of oil seeds is converted into oil, the greater portion being exported as such to foreign countries. In the year 1929-30 the value of exports of seeds amounted to Rs. 1,412.30 lakhs or 33 per cent of the value of the total foreign export trade of the Presidency in Indian produce and manufactures. The value of foreign exports of groundnuts during 1929-30 amounted to Rs. 1,338.97 lakhs representing 30 per cent of the foreign export trade.

The exploitation of the vast seed resources of the Presidency must depend to a great extent on general industrial development and the setting up of factories utilizing vegetable oils as a raw material. Soap factories are a case in point, as every additional soap factory that is established increases the demand for groundnut and cocoanut oil. A still more important potential outlet for vegetable oil lies in the manufacture in India of vegetable ghee on a large scale. If the manufacture of pure artificial ghee from vegetable oil is developed in India, it would result in the utilization in the country itself of an increasing quantity of the oil seeds

produced in the Presidency and the lowering to the public of the price of ghee and other fats. An increased quantity of oilcake would also become available to the ryots at a cheaper price for use as manure and the soil would consequently be enriched. Mettur would appear to be a suitable location for the establishment of a factory for the manufacture of vegetable fats by the hydrogenation process, as the main road to Madras from Calicut will pass through it, while it is in railway communication with Salem. In virtue of its proximity to such centres as Erode, Coimbatore, Pollachi and Palghat on the West Coast, a factory at Mettur would be able to secure almost all kinds of vegetable oils and fish oil in any quantity. If an export trade is developed, shipments can be made through the ports of Madras, Calicut and Cochin. An ample supply of water is assured while electricity will be available at a very favourable rate.

HYDROGENATION FACTORY

In view of the suitability of Mettur for the establishment of a hydrogenation factory, it may be worth while to discuss the possibilities of such manufacture. The hydrogenation industry is strongly established in Europe and America and hardened fats prepared from vegetable oils and fish oils, have, owing to their cheapness, now almost entirely replaced the use of mutton and beef tallow in soap factories in Europe. In America, there is a considerable production of hardened fats. In India there should be undoubted scope for the employment of the hydrogenation process, for, not only are the requisite natural oils available, but there is a good market for the products. The use of beef fat is objected to by Hindus and pig fat (lard) by Muhammadans. There should therefore be a steady and growing demand for hardened fats both for use in the manufacture of toilet soaps and as a suitable substitute for ghee. At present Indian soap manufacturers have to depend largely upon tallow (beef and mutton) in the manufacture of high class toilet soaps. Local tallow is of very indifferent quality and is extremely wasteful to refine, while the quality available is neither steady nor sufficient. On the other hand, tallow imported from Australia, New Zealand and England is very expensive. Soap manufacturers in India, who have to use at present an expensive tallow for high class soap are therefore placed at a disadvantage in competing with soapmakers in Europe. An assured and cheap supply of a suitable tallow substitute prepared from vegetable oils in this country would give a decided impetus to the development of the toilet soap industry.

HARDENED FATS

Among the other uses of hardened fats, the following are the most important: —

(1) Artificial ghee, ghee substitutes, margarine.
(2) Lubricants.
(3) Candles.
(4) Insulating compositions.
(5) In the tanning of leather.

(1) At present pure ghee is not available in India in sufficient quantities and the price also is very high, while most of the bazaar ghee is unwholesome and grossly adulterated often with deleterious substances. As a result, ghee substitutes manufactured in Europe are finding an increasing market in India. Although such products are not equal to pure ghee in the matter of flavour, taste, and nutritive value, they are harmless and are infinitely superior to the so-called ghee vended in the bazaars. The artificial ghee factories in Europe and America are now said to be adding something in the nature of a substance rich in vitamin to hardened fats in order to make up for the deficiency of this vital element which is necessary, though in a minute quantity for nutrition. These ghee substitutes are simply hardened vegetable fats or mixtures of such hardened fats and liquid vegetable oils such as cocoanut oil, sesame oil or groundnut oil blended with a small admixture of butter, fat or even ghee. In Europe hardened fats are now even replacing tallow and lard as shortening material in the manufacture of bread.

(2) Formerly tallow was commonly used in the manufacture of lubricants, but now hardened fish oil is gradually taking the place of tallow owing to its cheapness. An outlet for hardened fats should be found in the form of axle grease on railways as also in mills and factories which use tallow for the lubrication of machinery.

(3) Hardened fats are used in Europe in the manufacture of candles. Stearic acid obtained by the ordinary process of fat splitting and distillation is more expensive than hardened fats, as the process of preparing stearic acid is very elaborate and the output limited. For use in tropical countries, candles made from hardened fats are preferable to those made from mineral wax of a low melting point, as the latter, though cheap, are wasteful.

(4) As insulating composition, hardened fats are extensively used in Europe.

(5) In the tanning industry, stearic acid produced by the hydrogenation is used in place of olea-stearine. For stuffing harness leather, hardened fat is gradually taking the place of tallow.

It will be seen from the foregoing that hardened fats are used for a variety of purposes and that there should be a growing demand for such fats in India. India is importing annualy about 23,000 tons of vegetable fats, chiefly, from the Netherlands, most of which is consumed as edible fats or substitutes for ghee.

On the basis of the figures embodied in the foregoing statement, the cost per cwt. of hardened fat works out on an average to Rs. 388-4-0.

A GROWING MARKET

There already exists a good market in India for hardened fats, and the demand is likely steadily to increase. The possibility of developing an export trade in hardened fats should not be overlooked as such products in the form of solid slabs could be easily packed and shipped. The difficulty attending packing, liability of oil to become rancid, losses due to leakage, higher freight rates and other causes which now operate as an impediment to the successful development of the export of oil from India are factors which are absent in the case of shipment of hardened fats. The large quantity of oil consumed by the hydrogenation industry would give an impetus to the oil milling industry in the Presidency and to the cultivation of oil seeds which is passing through a difficult time. An hydrogenation factory at Mettur could either set up its own oil crushing mill or draw its supplies from oil mills in the surrounding country.

Report of the Eighth Annual Meeting of the Madras Geographical Association

The Eighth Annual Meeting of the Madras Geographical Association was held at 4-30 P.M., on Saturday, the 21st July at the University Department of Geography, Wesley College, Royapettah, with M.R.Ry. Rao Bahadur Krishna Rao Bhonsle Avl., in the chair.

The Report of the Association for the year 1933-34 was read and adopted, after which the Election of Office-bearers for 1934-35 took place. The following persons were elected for the Working Council for 1934-35:—*President*: Miss J. M. Gerrard, M.A.; *Vice-Presidents*: Miss E. D. Birdseye, B.Sc., and Mr. Rao Bahadur R. Krishna Rao Bhonsle, B.A., I.S.O.; *Secretary*: Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.; *Treasurer*: Mr. G. Narayanaswami, M.A., L.T.; *Other Members*: Miss K. S. Ranga Rao, B.A. Honours (London), F.R.G.S.; Mr. George Kuriyan, B.A., B.L., B.Sc. (London); Mr. T. L. Krishnamurthy Ayyar, M.A,; and Mr. B.M. Tirunarayanan, B.A., (Hons.)

The Report of the Tiruvallore Regional Survey Committee of the Association was then read, discussed and recorded.

A Standing Committee of Experts, consisting of the following members (with power to co-opt) was next appointed to answer references and advice educational authorities on technical matters such as text-books, syllabuses, schemes of study, etc.:—Miss J. M. Gerrard, Miss H. T. Scudder, Mr. N. Subrahmanyam, Mr. George Kuriyan, Miss K. S. Ranga Rao, Miss E. D. Birdseye, Mr. S. Muthukrishna Ayyar, Mr. G. Narayanaswami, and Mrs. P. S. Sundara Raj.

In bringing the proceedings to a close, the new President, Miss J. M. Gerrard paid a tribute to the steady and energetic work of the Secretary Mr. N. Subrahmanyam, but for whom, she said, the Association would not have come into existence or continued so long. She then appealed to the members to strengthen the finances of the Association by enlisting more members, making a practical suggestion that each member should try to get in one more member.

After the meeting terminated with a vote of thanks to the chair, the following Geographical Films were then put on the screen:—

(1) Sculpture of the Land by rivers and the Cycle of Erosion; (2) The Work of Underground Waters; (3) The Arid South-West; (4) Forest People of Central Africa; and (5) The Little Swiss wood-carver.

News and Notes

The Eighth Annual Meeting of the Association could not be held in April last ; and was postponed to July. An account of the meeting is published in this number. From the Annual Report, it will be found that membership went down considerbly (to about 300) in the past year. But as a result of the enthusiasm evinced by the members at the Meeting, membership has since been going up rapidly.

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The Tiruvallore Regional Survey, which was taken up as a fresh activity of the Association during the past year, had to be given up in the middle, as Mr. Krishnan who was doing the work under the guidance of a committee of the Association was awarded a University Research Studentship for continuing the work under the auspices of the University. A Report of the Regional Survey Committee along with Mr. Krishnan's Report of his work is printed in this issue.

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In the Annual Meeting a standing committee of experts consisting of teachers of Geography, in high schools, training schools and colleges, has been appointed in order to answer references and advise educational authorities on technical matters. The personnel of the committee will be found in the report of the meeting.

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It is gratifying to note that the call for reform in the teaching of Geography in the elementary schools has come from the teachers thmselves. We already referred to the Refresher Course in Bhavani. After the reopening of the schools in July, the Secretary was invited to address the elementary teachers at Vellore and at Ambur on Geography teaching in Elementary Schools. He also spoke to the teachers of the A. R. C. Higher Elementary School on the same subject.

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It is also pleasing to note that school excursions are getting to be more common in schools of all grades, and their advantages coming to be more generally appreciated. The Secretary is usually requested to organise and conduct or sometimes to give information and advice. One of these excursions was a hill climb on Kailasagiri, 2,880 feet above sea-level, 5 miles from Vellore. This was joined by several elementary and high school teachers of Vellore.

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We are sorry to note that Miss K. S. Ranga Rao, who has taken a high qualification in Geography, was transferred to do History work in the Queen Mary's College, and that she has since severed her connection with the college. What is a loss to Madras is a gain to Nagpur, where she is now lecturer in the Arts College for Women.

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The reaction of the new S. S. L. C. Scheme, where Geography stands to suffer in importance as we pointed out in the previous number of the Journal, has already been felt in several ways. For one thing the strength of the Diploma Class in Geography has fallen from 25 last year to 15 in the present year, and that of the Geography Section of the L. T. Class in the Teachers' College from over 40 in the last two or three years to 29 in the present year. This is clearly symptomatic of the ebb of the tide, which has reached its lowest level, we hope.

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The new syllabuses in Geography for B and C Groups are now ready ; and they have been included in this number. A useful commentary by Mr. N. Subrahmanyam has been appended. Teachers of Geography, who handle the syllabus, are invited to refer their doubts and difficulties to the Editor of the Journal, who will arrange to get them answered by experts.

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As in last year, an excursion has been organised for the Michaelmas holidays for a period of not more than 10 days. The places proposed to be visited are Kolar Gold Fields, Bangalore, Sivasamudram, Seringapatam, Mysore, Kannambadi, Pykara, Ooty, Coimbatore, Mettur, and Yercaud. The expenses are expected not to exceed Rs. 40.

Reviews

The Southern Continents. By Thomas Pickles. Book I—South and Central America. Book II—Africa. Book III—Australia, New Zealand and the Pacific Islands. Price 1sh./9d. each (J. M. Dent & Sons, Ltd., London).

The three books of the series are intended for Secondary School pupils who are taking a course preliminary to School Certificate or Matriculation. A comparative study of the climates of the Southern Continents introduces each of the three volumes, affording a conspectus and basis. After this, general physical geography of each of the continents is treated as preparatory to detailed regional study. In books I and III one chapter is devoted to Discovery and Exploration of South America and Australia respectively. The regional studies are presented in an interesting way with proper correlation of the physical and the human elements. A few suggestive exercises are given at the end of each chapter; and each volume is illustrated copiously with sketches, diagrams, maps and pictures. The get-up is neat and attractive.

Black's Geography Pictures: Set 6—*Asia.* Selected and edited by J. Fairgrieve. Price 1sh./6d. (A. & C. Black, Ltd., London).

This packet is the 6th of a series of 8 sets of geography pictures, selected and edited by the veteran teacher of Geography and its pedagogy, J. Fairgrieve, and published by the well-known publishers of finely illustrated series like Peeps at Many Lands. Their Travel Pictures are already in wide use; and this is a new venture on similar lines.

The set includes 64 pictures, which have been very carefully selected as representations of types, the chief aim in their choice being " to present only *pictures which make plain things to which there is continual reference in Geography lessons* and about which there is danger of misconception." Being printed on one side of the paper, they can be distributed to pupils for individual or class work and can be projected by means of the epidiascope.

The pictures are classified in four groups : types of relief, types of vegetation, types of human activity and types of human settlement. The bulk of them are in the third group ; and Indian pictures are over a third. A carefully prepared letter-press under each picture draws attention to the salient geographical features, which go to make it a type. The set is cheap for the value ; and we would strongly recommend their general use in schools.

Outlines of the Geography of the World. By Mr. G. Srinivasa Aiyar. Part I—The Southern Continents and North America. Price 12 as. (Srinivasa Varadachari & Co., Madras).

This book has been prepared in accordance with the Madras S.S.L.C. (A. Group) Syllabus, which has just been scrapped along with the scheme of which it was a part. It covers the portion that can be covered in Form IV. The treatment is clear and simple and makes a direct appeal to the pupils' imagination. The volume is copiously illustrated with sketch-maps, diagrams, and a wealth of representative pictures ; and each chapter closes with a few important questions and exercises.

A Middle School Geography (in three parts) in Malayalam. By Mr. E. J. Edona. Price 8 as. for Part I, and 10 as. each for Parts 2 & 3. (The Kerala Publishing Company, Calicut).

The general complaint with regard to the teaching of Geography in South Indian schools has been that the reformed methods have not yet filtered down to the middle school classes ; and that the text-book writers have not given any lead in this direction. Mr. Edona has done service to Geography teaching in Malayalam schools by attempting to remove this defect. He has planned and prepared this series of books on right lines by reducing the amount of mere geographical facts, introducing plenty of practical work at each stage and in each lesson and by emphasising only certain aspects of world geography in each year instead of making an exhaustive survey of a particular continent every year as has been the vogue hitherto. The book has been illustrated with innumerable sketch-maps, diagrams and tabular statements of statistics as well as pictures. As this is one of the very few books in vernacular written on right lines, we have no hesitation in recommending it for use in Kerala schools.

Books and Journals Received

Outlines of the Geography of the World (Part I). By Mr. G. Srinivsa Ayyar.

A Middle School Geography (Three parts) in Malayalam. By Mr. E. J. Edona.

Black's Geography Pictures—Set 6 : *Asia*.

The Southern Continents : 1. South and Central America. 2. Africa. 3. Australia and New Zealand. By Thomas Pickles.

Proceedings of the Royal Geographical Society of Australia for 1932-33, Volume XXXIV.

Exhaustive Questions on the Southern Continents. By S. Joseph.

The Indian Review—May, June and July 1934.

The Educational Review—May, June and July 1934.

The South Indian Teacher—May, June and July 1934.

The Geographical Journal—May, June and July 1934.

The Gardening Review—May, June and July 1934.

Kalaimagal—May, June and July 1934.

Mitteilingen Der Gesellschaft Fur Erdkunde zu Leipzig —1931-32.

The Scottish Geographical Magazine—May and July 1934.

The Himalayan Journal—Volume VI : 1934.

Geography—June 1934.

The Journal of India History—April 1934.

The Geographical Review—July 1934.

The Indian Educator—June and July 1934.